SCIENCE.

FRIDAY, FEBRUARY 29, 1884.

COMMENT AND CRITICISM.

SOMETHING was said in these columns recently about the shortcomings of geography-teaching in the lower schools. The same complaints hold in regard to elementary science teaching in general. The wave of enthusiasm for teaching science in primary and middle schools, which swept the country a few years ago, has not brought us as much nearer the millennium as was at first fondly anticipated; but it has left many of us wiser, if not sadder. There was at first a general but strange misconception of what ought to be taught, and how the teaching was to be done. A poor workman with bad tools, which he does not know how to use, is hardly likely to turn out a finished product. One distinguishes genuine metal by its ring, only after he has heard it many times; and a teacher who knows little or nothing of any department of science is easily caught by the tone of a text-book which is often little better than a base alloy. 'Science made easy' finds its way into the school-room to the temporary delight of both teacher and pupil, but to the lasting benefit of neither.

Have the scientific men of this country done their full duty in this matter? It is a pertinent question, and it cannot be answered in the affirmative. Two forces are here to be dealt with, — the teachers and the text-books. Concerning the latter, it will be remembered by many that something akin to a sensation was produced, at the Minneapolis meeting of the American association for the advancement of science, by Professor Rowland's vigorous denunciation of American science text-books. His resolution was doubtless too sweeping in its character, — more so, in fact, than was really intended by its author; but it cannot be denied that it contained a large measure of wholesome truth, however unpalatable it might have been. But can Professor Rowland and others, whose names will occur to the reader, hold themselves wholly free from responsibility in the premises? It is not unreasonable to assert that the preparation of text-books, including those that are elementary in their character, ought to be undertaken by specialists; and it is gratifying to know that many eminent American scholars have not shrunk from their duty in this respect. A few years ago, in a review of an elementary treatise on physics, Clerk Maxwell remarked that there seems to be "some opposition between accurate statements and school-teaching, which, if not a fundamental necessity, is at least a universally existing phenomenon in the present order of things." Nowhere is the hand of a master more needed than in the making of an elementary text-book. Science can be 'made easy' by being made clear and accurate; and such elementary treatises as those prepared by Maxwell and Balfour Stewart show how well the real scholar can do this. It can hardly be done by any one else.

THE recent deliberations of the committees of the American ornithologists' union, upon the rules of zoölogical nomenclature, will, when published, be of great interest to zoölogists working in other classes. The day is not far distant when the nomenclature of American zoölogy, particularly in its vertebrate division, will be reduced to a uniformity based upon consistent interpretation of the law of priority. American zoölogists are now waiting with much curiosity to see what their fellow-workers in Europe are going to do in the matter, and whether it be possible that they will cling to the illogical and inconsistent usages now prevalent among them. At present the names sanctioned by the great authorities, like Cuvier, appear to be regarded as sacred and immutable. In a recent official report upon the

Berlin fishery exhibition, Professor Giglioli, the leading authority in Italian vertebrate zoölogy, commenting upon the collections sent from the U. S. national museum, remarks, "I feel obliged to make reference to the singular nomenclature current among the zoölogists of the United States, which is in most instances entirely arbitrary, and at variance with that generally adopted in Europe. Only the working zoölogist can form an idea of the confusion which is sure to result from such practices. If the present courses are continued, they will end in the destruction of the wise, convenient, and simple *sistema zoologico* conceived by the great Linnaeus."

Most English zoölogists follow, though not very consistently, the rulings of the Stricklandian code; but on the continent, except in Norway, there appears to be no general appreciation of the importance of conforming to any consistent policy in nomenclature. The authority of Cuvier, or one of his contemporaries, is allowed to outweigh any consideration of justice or uniformity. In the United States, however, the number of indigenous species to be systematically catalogued is so great, that systematic zoölogists have been forced to follow the rule of priority, without fear of contemporaries, or favor to the workers of the past. It is somewhat unfortunate that the common sea-bream of Europe should be known to transatlantic ichthyologists as Sargus vulgaris, while here it is called Diplodus sargus; equally so, that our black bass, Micropterus salmoides, should there be known as Huro nigricans. The American zoölogist has, however, the advantage of standing on a foundation of priority, upon which his European brethren must sooner or later take refuge, or be overwhelmed in an ocean of synonymes.

In closing a review of the different means employed by man to rid himself of destructive insects, Mr. de Fontvielle expresses a regret that the attempts made to popularize the use of insects as food have made so little progress. We are, in fact, behind the Chinese, and even behind the monkeys, who, if we may believe Millet, eat their own lice. It is not necessary, he adds, to go to this length; but we ought not to forget the remark of the Roman emperor, who said that the body of an enemy never tasted bad, and the banquet of the Society of insectology, before which he spoke, would always lack something so long as there was not placed before them at least some grasshopper farina and fried white worms.

'Characterized by high, unbroken mediocrity' is the description which the *Pall-mall gazette* gives of the literature of the past year. This only brings up again the question whether the age of literature and of good talkers, as well as writers, may not be passing away. The energies of a large portion of the able men of the present are occupied by the work of their special avocations, — avocations in which they have few associates, or possibly none, in their particular branch. What has the foremost position in these men's thoughts they find no opportunity of mentioning to those with whom they may be thrown. Where Franklin found time to be a printer, a statesman, and a physicist, is now so much ground to be covered, that a physicist may soon be a thing of the past; the electrician possibly being quite ignorant of the laws of heat, and each student only striving to cover faithfully the subject of sound, or light, or heat, as may seem most attractive. Shall the active man of the future limit himself in his department that he may gain a polish that will make him the more agreeable companion? or, that he may serve the world's purpose the better, shall he, by his education, largely separate himself from all others? What this differentiation has come to, is shown by the fact that a learned academy not long ago honored with a gold medal a memoir which no member had read. A meeting of this society has often been compared to a funeral, — a funeral only to be enlivened by the queries of some garrulous layman; and how can it be otherwise when the words of our wiseacre fall upon the ears of others, incapable of vibrating in sympathy?

LETTERS TO THE EDITOR.

A clock for sending out electric signals once an hour or oftener.

It is necessary that the central clock of a system of controlled clocks should send out an electric signal once an hour, by means of which signal the controlled clocks have their hands set to time.

It is often convenient to have such a clock send out signals oftener than once an hour: for example, at the University of Wisconsin a central clock automatically rings an electric bell in each recitation-room at the end of each hour, and also at ten minutes before the end of the hour, i.e., at fifty minutes and sixty minutes.

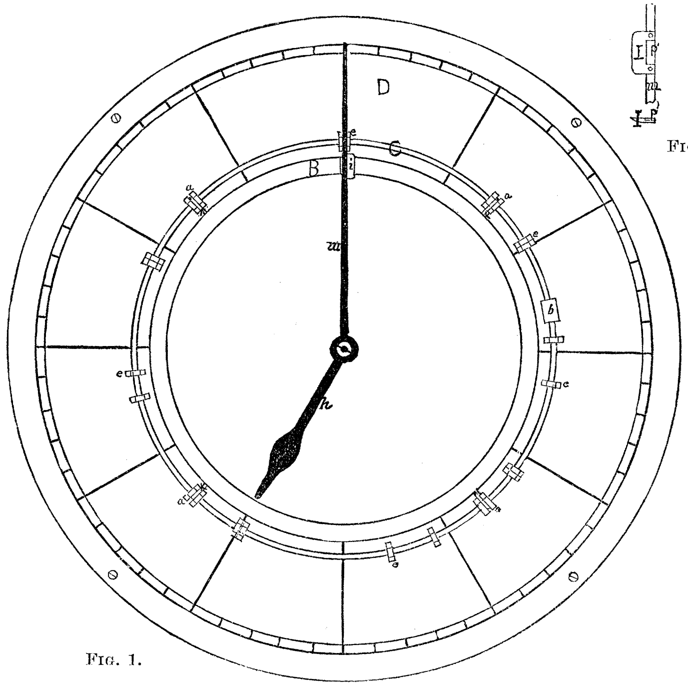


FIG. 1.

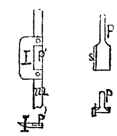


FIG. 3.

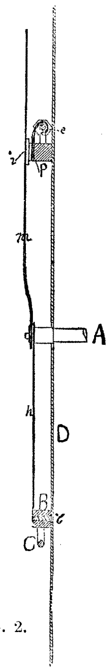


FIG. 2.

There are many ways of accomplishing this end. One of the simplest of these is described below from a clock which is now in use at the Washburn observatory to control by hourly signals a system of secondary clocks in the city of Madison.

The apparatus was made in the University machine-shops by me, and cost, perhaps, five dollars; and it is perfectly satisfactory in its operation. Figs. 1 and 2 represent the projection and section of an ordinary clock-dial, with a ring of black walnut or ebony, *B*, screwed on it.

Around the outer circumference of *B*, and about a quarter of an inch from it, runs the brass wire *C*. This wire is threaded from end to end, and, passing through the four screw-eyes *k*, *k*, is held to, and supported by, the wood ring *B*. The two ends of the wire are joined by means of a long nut, or thimble, *b*. Strung loosely on the threaded ring *C*, and at various points of its circumference, are the small brass nuts *a*, *e*. Some of these are employed as jam-nuts, *a*, *a*, to prevent any tangential motion in the threaded ring. The walnut ring can be made of convenient thickness, so that the minute-hand will pass over it; and for final adjustment the minute-hand may be bent in or out to get the required contact pressure. A thin strip of platinum (*P′*, fig. 3) is soldered to the under side of the minute-hand along the portion which traverses the walnut ring *B*. Around this *point* is fitted the small block, *I*, of bone or vulcanite, with its under face sloping upward to form a sort of inclined plane to precede the platinum point *P′*. A short piece of platinum wire of suitable size is flattened at one end (*P*, fig. 3); and the flattened part, secured to the small piece of vulcanite, *s*, is laid upon the walnut ring *B*. The other end is bent round the threaded wire *C*, and secured in place by means of the nuts *e* strung on the ring for that purpose.

The points at which the circuit is made and broken are the platinum points *P*, *P′*. The minute-hand, being carried around with its point *P′* in light contact with the ring *B*, is sprung out when the inclined block *I* comes in contact with the projection of *s*; and, being carried along, the points *P*, *P′*, are brought together by the springing-back of the hand. The length of contact depends on the width of the point *P*, and may be varied at pleasure. The circuit-wires are led from the works of the clock and the threaded ring respectively, and may be provided with suitable binding-posts outside the clock. As the ring *C* runs clear around the dial, a platinum point may be inserted anywhere in its circumference; so that any number of signals may be made during the hour, or those already set may be easily changed. The nuts *e* on the threaded wire not only insure a good metallic contact with the platinum point, but aid materially in its adjustment for a given time of contact. The device is simple, in that it requires no great delicacy of workmanship in its construction, and is of such a form that almost any clock will receive it without change.

H. W. PENNOCK.

Deafness in white cats, and statistics of deafness and epilepsy in America.

In my letter of the 4th inst. (*Science*, iii. 171) I drew attention to the remarkable fact, that white cats, if they have blue eyes, are almost always deaf.

Darwin, in his book on 'Animals and plants under domestication,' attributes the peculiarity to a slight arrest of development in the nervous system in connection with the sense-organs. He thinks there is nothing unusual in the relation of blue eyes and white fur; but in regard to the deafness, he says (ii. 323), —

"Kittens, during the first nine days, whilst their eyes are closed, *appear to be completely deaf*. I have made a great clanging noise with a poker and shovel close to their heads, both when asleep and awake, without producing any effect. The trial must not be made by shouting close to their ears; for they are, even when asleep, extremely sensitive to a breath of air. Now, as long as the eyes continue closed, the iris is no doubt blue; for, in all kittens which I have seen, this color remains for some time after the eyelids open. Hence, if we suppose the development of the organs of sight and hearing to be arrested at the stage of the closed eyelids, the eyes would remain permanently blue, and the ears would be incapable of perceiving sound; and we should thus understand this curious case. As, however, the color of the fur is determined long before birth, and as the blueness of the eyes and the whiteness of the fur are obviously connected, we must believe that some primary cause acts at a much earlier period."

Darwin's conclusion is supported by a remarkable case recorded in France by Dr. Sichel (*Annales sc. nat., Zool.* 3d series, 1847, viii. 239), in which the iris, at the end of four months, began to grow dark-colored, and *then the cat first began to hear!*

In the human race, also, while it is exceedingly problematical how far congenital deafness is associated with a deficiency of coloring-matter in the skin and hair, it appears, according to Darwin ('Animals and plants under domestication,' ii. 322), that some relation exists between various affections of the eyes and ears.

He states that Liebrich found, upon examining the eyes of 241 deaf-mutes in Berlin, that no less than fourteen suffered from the rare disease called pigmentary retinitis. He also states, upon the authority of Mr. White Cooper and Dr. Earle, that color-blindness is often associated with a corresponding inability to distinguish musical sounds.[1]

I have already shown that the census returns for 1880 indicate that the proportion of deaf-mutes among our colored population is much less than among the whites; but private inquiry at the census bureau seems to show that the proportion of *congenitally* deaf among the colored deaf-mutes, instead of being less, is very much greater, than among the white deaf-mutes.

Of 19,475 white deaf-mutes, 10,738 (or 55 per cent) were stated to have been born deaf, and 8,737 (or 45 per cent) were returned as deaf from disease or accident: on the other hand, of 1,751 colored deaf-mutes, 1,301 (or no less than 74 per cent) were reported as congenitally deaf, and only 450 (or 26 per cent) as deaf from disease or from accidental causes.

By the kindness of Gen. Seaton, I am enabled to give the following unpublished figures from the census returns bearing upon the point: —

Number of deaf-mutes in the United States, living June 1, 1880, *arranged according to race and sex.*

Causes of deafness.	Colored.		Foreign white.		Native white.		Total.	
	Male.	Female.	Male.	Female.	Male.	Female.	Male.	Female.
Congenital . . .	714	587	545	444	5,229	4,520	6,488	5,551
Injury to ear . .	7	2	8	2	34	17	49	21
Disease of ear . .	7	8	10	7	204	166	221	181
Other diseases . .	178	147	306	252	4,172	3,368	4,656	3,767
Miscellaneous . .	73	28	81	77	610	423	764	528
Not stated . . .	..	..	..	..	..	..	6,389	5,263
Totals	979	772	950	782	9,249	8,494	18,567	15,311

[1] These statements are taken from Mr. Sedgwick, in the *Medico-chirurg. review*, July, 1861, p. 198; April, 1863, pp. 455 and 458. Liebrich is quoted by Professor Devay in his 'Mariages consanguins,' 1862, p. 116.

In my former communication I quoted from Dr. Lawson Tait's paper on 'Deafness in white cats' (*Nature*, xxix. 164) the following remarkable statement: "Every kind of white animal I have kept as a pet has proved to be the subject of epilepsy; and the association is suggestive, when we are told, as I have been frequently, that the disease is unknown among negroes."

I presume that Dr. Tait must have referred to the negro in his native habitat; for I find, upon inquiry at the census bureau, that epilepsy appears to be more common among the colored people of America than among the whites. I am indebted to the courtesy of Gen. Seaton for the following unpublished figures from the tenth census: —

Percentage of epileptics in the United States, 1880, *by race and sex.*

White male	.004749
White female	.003751
Black male	.005011
Black female	.004267
Indian male	.002942
Indian female	.003084
Chinese male	—
Chinese female	.020925

These results will doubtless be of interest to your readers. Alexander Graham Bell.

Washington, D.C., Feb. 29, 1884.

In a letter to *Science* of Feb. 15, Prof. A. G. Bell quotes from Dr. Lawson Tait, that "every kind of white animal I have kept as a pet has been the subject of epilepsy; and the association is suggestive when we are told, as I have been frequently, that the disease is unknown among *negroes*." This remark in regard to the negroes, I know, cannot be entirely true. I am a southern-born man; and I have seen a great deal of negroes all my life, and have always considered that epilepsy prevailed among them, even to a greater extent than among white people. I can easily give a number of instances of its occurrence, coming under my own observation and that of my friends to whom I have mentioned the subject.

Georgetown, D.C., Feb. 21, 1884. Benj. Miller.

The Krakatoa eruption.

The council of the Royal society has appointed a committee for the purpose of collecting the various accounts of the volcanic eruption at Krakatoa, and attendant phenomena, in such form as shall best provide for their preservation, and promote their usefulness.

The committee invite the communication of authenticated facts respecting the fall of pumice and of dust, the position and extent of floating pumice, the date of exceptional quantities of pumice reaching various shores, observations of unusual disturbances of barometric pressure and of sea-level, the presence of sulphurous vapors, the distances at which the explosions were heard, and exceptional effects of light and color in the atmosphere. The committee will be glad to receive, also, copies of published papers, articles and letters, bearing upon the subject.

Correspondents are requested to be very particular in giving the date, exact time (stating whether Greenwich or local), and position whence all recorded facts were observed. The greatest practicable precision in all these respects is essential.

All communications are to be addressed to

G. J. Symons,

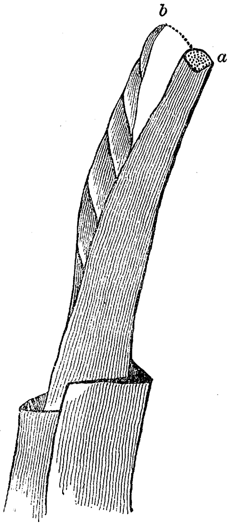
Chairman Krakatoa committee.

Royal society, Burlington House,
London, Feb. 12, 1884.

Expulsion of water from a growing leaf.

My attention was some time ago called to an interesting and remarkable fact in connection with the expulsion of water from the tip of a growing leaf. It is well known that drops of water are often found on the margins and apices of growing leaves. It is readily observable in corn and other grasses (see Sachs's text-book, p. 676); but the phenomenon to which I wish now to call attention is of another character. The circumstances were as follows: —

A lady had growing in her house a strong and thrifty Caladium with three or four large leaves. A new leaf being ready to expand alongside of an old one, this last was cut off at *a* in the figure. It was noticed soon afterward, at about half-past ten A.M., that from the apex of the new leaf (*b*) there was being shot out, for a distance of about an inch, a jet of water, falling in the shape of very fine spray on the cut surface of the other leaf. The jets were counted, and it was found that there was a regular *pulsation of about a hundred and eighty per minute;* that is to say, three jets of water were forced from the apex of the leaf every second. It was observed from time to time until five P.M., and but little cessation of the rate of motion was seen. At eight the next morning the pulsations were about a hundred and twenty per minute; and they gradually decreased, until, on the third day, drops of water would accumulate at the apex, and be expelled with some force at a rate of about ninety per minute.



It is to this regular pulsating movement of the water that I wish to call attention. I cannot find, in any of the books accessible to me, any account of any such motion in the water of plants. Sachs does not mention it; and, if any of your readers know of the mention of any such motion, I should like to know where it is to be found. We know that the exudation of water from cut surfaces, or newly-expanding leaves, is often caused by the taking-away of an evaporating surface (say, a large leaf) while the root is still absorbing a large amount of moisture from the soil (see Sachs's text-book, p. 689); but why this pulsating movement? There can be no doubt as to the accuracy of the observation, as it was seen by several persons besides the owner of the plant. Prof. J. W. Lloyd of this city has informed me that some years ago he made the same observation, but he has not been able to give me an exact statement as to what took place.

JOSEPH F. JAMES.

Cinc. soc. nat. hist., Cincinnati, O.

[This interesting phenomenon has been described by Musset, who states that water was forced from the leaf-tips of Colocasia antiquorum, another plant of the Aroid family, with such force that the jet was three inches and three-quarters high (*Comptes rendus*, 1865, 683). Professor Pfeffer, to whom we are indebted for this reference, calls attention to a singular communication by Munting (1672), who describes the emission of a fine stream of water from the leaves of certain Aroideae, *resembling a fountain.*]

A scientific swindler.

A few weeks ago a man calling himself N. R. Taggart, and claiming to be a member of the Ohio geological survey, visited Philadelphia. He called on the principal scientific men of this city, and attended one of the regular meetings of the Academy of natural sciences. He seemed to have an extended acquaintance with scientific men all over the country, talked very glibly about fossils, and claimed to be preparing a report on the Productidae for the Ohio survey. He is about five feet eight inches in height, a hundred and sixty pounds in weight, heavy set, heavy featured, with light hair, and rather deep-set eyes, shabbily dressed, and wore an old gray overcoat. He had an adroit way of ingratiating himself into the confidence of his intended victims; and then, if he could not steal, he would, under some plausible pretext, borrow valuable books or specimens to take to his hotel, and forget to return them. His victims are to be found scattered all over the country. In New York he was E. D. Strong of Fort Scott, Kan., and claimed to be employed by the Kansas Pacific railway to collect statistics of coal production. In West Philadelphia he gave his address as E. Douglas, Columbus, O., member of the State survey. In Auburn, N.Y., he was a deaf-mute, under the name of E. D. Whitney, U. S. geologist, Denver, Col. There he obtained a large quantity of valuable books and fossils from the family of Professor Starr, in the absence of the owner. In Harrisburg, Chambersburg, Columbus, and Indianapolis he was a deaf-mute. He swindled the state geologist of Indiana out of over a hundred dollars' worth of scientific books. From the Cleveland historical society's rooms he obtained Indian relics of great value, and in Cincinnati, minerals and fossils which he converted into cash. He has been permitted access to several museums, public and private, from which he has succeeded in abstracting valuable specimens, and sold them. Any information in regard to the real name and residence of this man is much to be desired.

F. V. HAYDEN.

AN INTERNATIONAL SCIENTIFIC ASSOCIATION.

THE coming of the British association in August next to this continent to hold its meeting will result, it is hoped, in bringing the scientific representatives of two great nations twice together, — once at Montreal; and later, again, at Philadelphia. The interest felt in these two gatherings is very great, and rapidly increasing as the time approaches for their occurrence. It is realized that they will be very important and delightful. Both meetings will be international in character; and the pleasant anticipations formed in regard to them suggest the advisability of establishing some permanent organization which may insure

the recurrence of similar opportunities in the future.

There are many persons who have long wished that an international scientific association should be formed, where those of similar pursuits could meet one another, and, as it were, exchange thought between the nations. All acknowledge that the chief value of the large general associations lies in the stimulus of personal intercourse and discussion; and this would doubtless apply still more decidedly to an international society. The principal purpose of its meetings would be, we doubt not, to secure that stimulus.

An international scientific association would necessarily be largely European, and Americans would have to cross the ocean to attend its sessions. But with our habits of active travel, this necessity cannot be thought likely to prove a serious obstacle to our active participation in the association; which might, too, at some time, be induced to follow the example of the British association, and meet upon our side. Perhaps no opportunity will soon recur so favorable for the formation of the suggested association as the meeting at Philadelphia, and it seems very possible that the initiative may be there taken. The two English-speaking races can then act in concert, and, by a double appeal, more easily achieve the result than either could alone. America takes no share in the international complications which agitate Europe, and is therefore a friend with all, and might, on that account, the more readily inaugurate such a general movement.

Some limitation would necessarily be made upon the membership of the body suggested, confining it, perhaps, to original investigators. It is a question how far the indiscriminate presentation of scientific communications could be made feasible; for, if the whole of the annual additions to science were to be presented, the association would sit the entire year. Obviously some restrictions are requisite: their character must be decided by discussion and experience. Thus, formal addresses upon special subjects, or discussions limited to specified topics, might serve the purpose; or it might be considered wise to follow the example of the new Society of naturalists, which devotes its attention to the ways and means, the practical technique, rather than the results, of science. We hope that the plan we have briefly indicated will meet at least with consideration, and awaken discussion, so that it can be ascertained whether it ought to be pursued farther. It is too early yet to venture upon any definite proposals.

THE ALASKA MILITARY RECONNOISSANCE FOR 1883.[1]

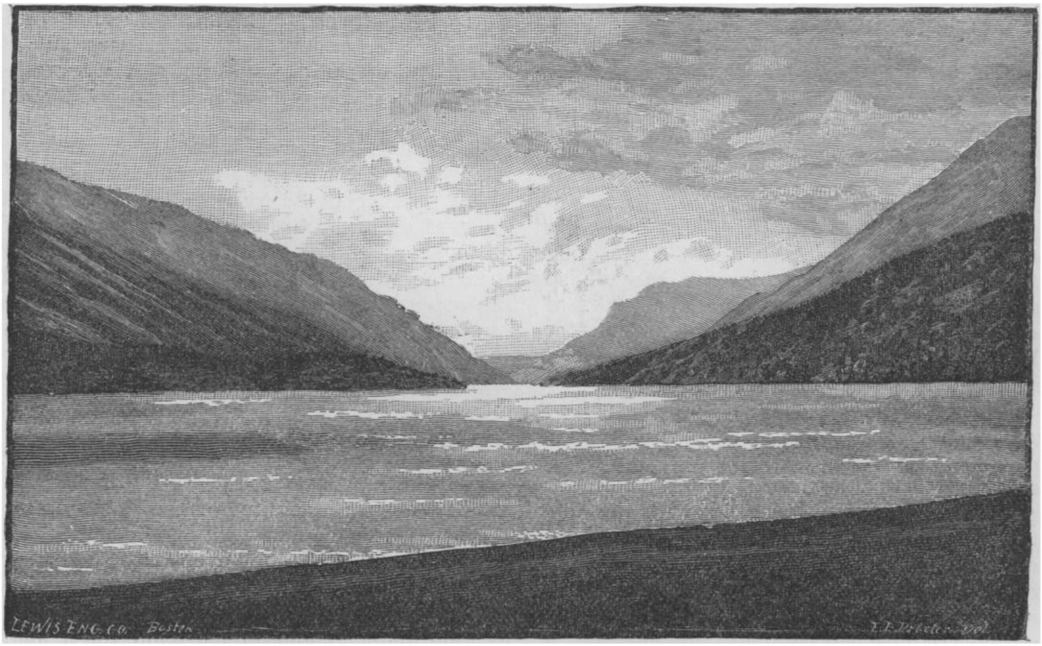
LEAVING Tahk-o, the Yukon, for the first time, assumed something of a riparian air, the draining river being nine miles long. It is from three hundred to four hundred yards in width, very swift, and the first part of its course full of rocks and great bowlders, that make its navigation hazardous for even a stanch raft. On its right-hand bank stood a roughly built Tahk-heesh house, the only one on this part of the Yukon River for hundreds of miles on either side; and even it was deserted. The next lake was nearly thirty miles long, and appreciably wider than those through which we had sailed. I called it Lake Marsh, after Professor Marsh of Yale college.

I have spoken of a great number of glaciers that were constantly encountered, and the white condition of the water emanating from them. In Lake Marsh the water near the shores was very shallow, owing to large deposits of this fine glacier mud; and we often found it impossible to get much nearer the beach than sixty to eighty yards, although our craft drew less than two feet of water. When a high wind lashed the lake into waves, these mud deposits gave a clear-cut outline between the whitened water within their exterior edges and the deep blue water beyond, that showed in many places an extension of the deposits of four hundred to five hundred yards from the beach. It is possible that the stages of water may vary in Lake Marsh at different seasons sufficient to lay bare these mud-banks, or cover them so as to be navigable for small boats; but there seemed to be a wonderful uniformity in the depth of the water over these banks in every part of the lake, being about eighteen inches. Through this tenacious mass, that even threatened to pull off our rubber boots, we would have to carry our camping-material each evening as we went into camp, and each morning as we broke it for our departure. The trees on the hills overlooking the lake, as had been often noticed before on the upper waters of the Yukon, all leaned more or less conspicuously towards the north, or down stream, thus plainly showing the prevailing direction of the stronger winds. Faint signs of terraces were still to be seen on the hillsides; but they were lower, nearer together, and not so well marked as on Lake Nares. The level ridges on the eastern hills were still covered with the luxuriant yellow grass of last year's growth, and, as we viewed

[1] Continued from No. 55.

them from the lake, turned one's thoughts to the stubble fields of grain in temperate climes.

On the 28th, on Lake Marsh, a spirited rain and thunder shower lasted from 12.45 P.M. to 2.15 P.M., and is, I believe, the first thunder-storm recorded on the Yukon, it being unknown on the lower river, according to all accounts. It brought us a head wind; and, after dying out, a favorable breeze sprang up, and kept us going until 12.30 next morning, so essential was it for us to take advantage of all favorable wind. At midnight it was so light, however, that but one star could be seen in the unclouded sky, — the planet Venus. For the first time bathing was possible in the lakes, although not pleasant, except on very warm, still days.



LAKE BENNETT FROM PAYER PORTAGE.

Iron-capped mountains on the right, covered with fog.

The northern shores of Lake Marsh are especially flat and boggy, making our camps very disagreeable. Our rough mode of navigation also suffered from the ceaseless banks of 'glacier-mud' as we approached its outlet, most of which was probably deposited by a large river (the McClintock [1]) that here comes in from the east, — a river so large that we were in some doubt as to its being the outlet, until its current settled the matter by carrying us into the proper channel. This channel much more closely resembled some of the streams in temperate climes than any we had met. Its flanking hillsides of rolling ground were covered with spruce and pine, here and there breaking into pleasant-looking, grassy prairies, while its own valley was densely wooded with poplar and willows of several varieties. These latter, in fact, encroached so closely upon the very water's edge in such impenetrable confusion that camping-places were hard to find, unless a spur from the hills, covered with evergreens, wedged its way in on the river's face to break the continuity of this barrier to a night's camping-place. The raft's corduroy deck of pine poles often served us for a rough night's lodging.

Muskrats were plentiful in this part of the river, and in the quiet evenings a number could be traced at once by their wedge-shaped ripples as they were swimming about. Small broods of ducks were also occasionally noticed, and numbers of the great American diver were seen on almost all the lakes.

On the 1st of July, with a Tahk-heesh Indian as a guide, we approached the great rapids of which we had heard so much. An inspec-

[1] In honor of Vice-Admiral Sir Leopold McClintock, Royal navy.

tion of them showed that they were really quite formidable and dangerous for any sort of craft whatever. Nearly five miles in length, the first half or three-quarters of a mile is through a cañon from fifty to sixty feet deep, where the original stream is contracted to one-eighth or one-tenth its former width, and through which the river fairly boils. This cañon, the only true one on the Yukon River,[1] is composed of basaltic columns, so regular that they are not unlike representations of the Giant's Causeway on the Irish coast. In the centre of its length it expands into a large, circular, basaltic basin seventy or eighty yards wide, or double the width of the cañon proper; and here the water's edge could be reached on the west shore. After leaving the cañon, the channel expands into a sheet of rushing rapids, often three hundred to four hundred yards wide, broken by rocky bars into frothy chutes full of bowlders and foaming and bristling dams of lodged and water-logged timber, ten times more dangerous than the cañon itself, although not so in appearance. About four miles of this brings us to the end, where the river, again contracting into a few yards, shoots down a cascade so narrow and swift that the ascending banks of rock are covered with the rushing current that falls over their sides in sheets, and makes it a veritable funnel of foaming water.

Through this cañon, rapids, and cascade we shot our raft July 2, losing the two side-logs in a collision in the cañon with its basaltic columns, and, just below the cascade, hauled in for repairs, and to redeck the raft with the fine straight spruce and pine poles that we here found in large quantities, thoroughly seasoned by some fire that had destroyed them two or three years before. Like all the Coniferae growing in dense masses, these timber districts have their periodical devastations of fire; and years after, the fallen timber, coupled with the new growth, makes pedestrianism border on the impossible.

A few Tahk-heesh Indians had been employed by us in our labors around the Miles' cañon and rapids;[2] and I was forced to contrast their great kindness to each other, and especially to their women, with the conduct, the very reverse, in the Chilcats. These Chilcats, in tracking canoes up the Dayay, refused to convey the loads of their fellows not provided with these craft, although to have done so would have necessitated no extra labor, thus compelling the latter to carry their packs as they did over the Perrier Portage. They would not even ferry them over the swift Dayay, forcing them into long détours or perilous crossings up to their middle in the rapids. Even in cases of sickness they would do nothing for their comrades, unless compensated by a part of the payment.

Grayling were caught in large numbers in and around these rapids, some four hundred to five hundred being secured by the party. They were also caught in straggling numbers from Lake Bove, until White River, below old Fort Selkirk, was reached. Moose and caribou (woodland reindeer) tracks were abundant, but no animals seen; and the dense swarms of mosquitoes were amply sufficient to convince any one that the tracks of an animal were the only part that could remain in the country during this part of the year. These pests, coupled with the gnats, were the greatest discomfort that the party was called on to bear; and there was no cessation from them the whole length of the river, although the upper part was much the worst. The dense smoke of the camp-fire was always crowded with the party whenever the wind was not blowing, and meals were eaten under mosquito-bars for protection. From the time the snow is half off the ground until the first severe frost comes, no one disputes the valley with them. Dogs have been known to be killed by them; and, after two or three months of the closest intercourse with them, I was willing to believe the Indian stories that they even slay the brown and grizzly bear of these regions.[1]

I noticed that a Tahk-heesh Indian, in arranging his head and breast-band for a load, pulled the former forward until taut, and the latter just far enough beyond to allow the width of his hand between them, when they were considered adjusted. I had also noticed this among the Chilcats.

One evening, about eight, while encamped some four hundred or five hundred yards below the cascades in the Miles' rapids, we could hear dull, heavy concussions in single blows, at intervals of every two or three minutes. It was noticed by more than one, and thought by some to be possibly distant thunder, although it sounded strangely unlike that noisy

[1] I mean by a *true cañon* one with perpendicular or practically perpendicular sides, although every precipitous and deep valley in the west is often called a cañon. With such an understanding, it would be impossible to tell where a cañon ended and a valley commenced.

[2] Named after Brevet Major-Gen. Nelson A. Miles, U.S. Army, commanding department of Columbia, in which Alaska is situated.

[1] This statement is asserted as a fact by some Indians and white traders, who state that the bear, in trespassing upon a swampy habitation of mosquitoes, instead of seeking safety in flight, rears upon his hind-quarters, and fights them bear-fashion, until his eyes are closed by their repeated attacks, when starvation is the real cause of death.

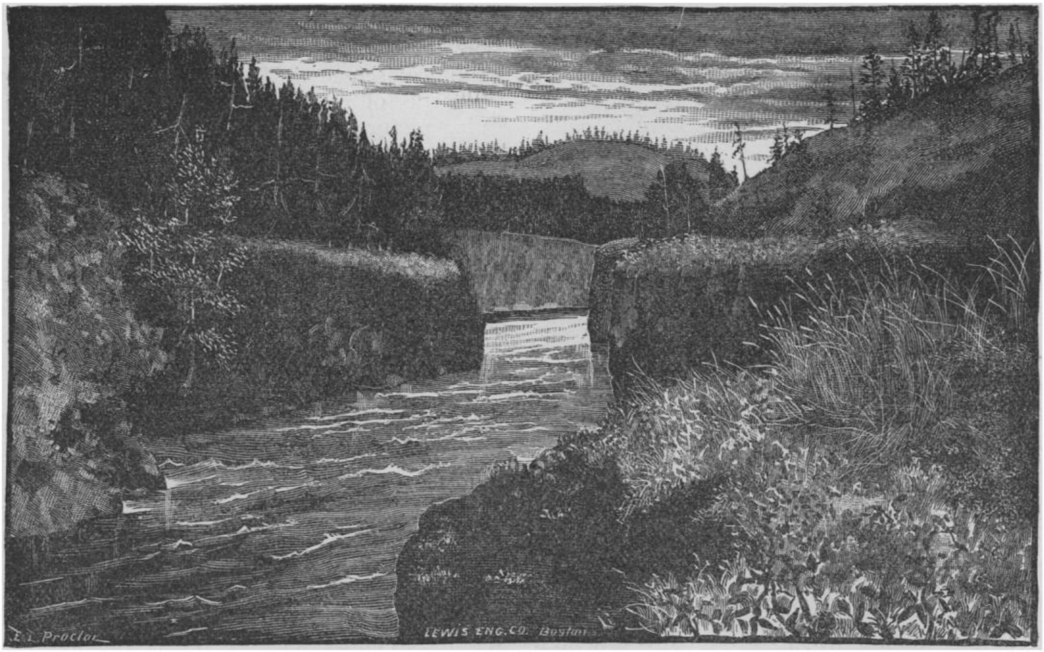
element; and the sky, too, was cloudless. A very light series of earthquake-shocks also seemed a poor theory; and there was but little left to attribute it to, except the cascades, which, I believe, have been known to cause earth-tremblings and analogous phenomena.

About noon on the 5th of July we passed the Tahk River (Tahk-heen-a of the Indians) coming in from the west, and which is probably two-thirds the size of the Tahk-heesh, as the Indians call the Yukon proper. While the former river is the smaller, its bed and valley apparently determine the general characteristics of the stream farther on, the Yukon here noticeably changing from high bold bluffs of clay to lower shores wooded to the water's edge. The last of the chain of lakes was reached the same day, and we were prevented from taking advantage of a good wind by a three-hours' detention on a sand-bar that the river had made almost entirely across its mouth. This lake was called by the Indians Kluk-tas-si; and, as it was one of the very few pronounceable Indian names of this section of the country, I retained it, although it is possible that this may be the Lake Labarge of some books, the fact that it is the first lake above old Selkirk being the only data in its favor, while its relation to other important points are equally against it. Like Lake Marsh, it is full of mud-banks; its emerging waters being clear, while its incoming supplies are loaded with deposit. So full of these is Kluk-tas-si, and so much more contracted is the water-way through them, that I think we were able to detect a slight current when making our way along in the blue water. This was especially noticeable when the wind died down to a calm. Despite all this, Kluk-tas-si was better for making landings on its shores than Marsh. It seems that it must be a mere matter of short geological time when these lakes will be filled by deposits, and converted into limited parts of the river. Such ancient lakes are noticeable in the course of the great stream farther on. The west bank of the last lake is very picturesque about fourteen or fifteen miles from its entrance, where large towers of red rocks throw up their conspicuous flanks on what seems to be a well-marked island, but which is really a part of the mainland, our Indians assured us. Here, also, comes in a river, say the same authorities, abounding in banks of the same material, and called by them the Red River. The frequency of this name in geographical nomenclature was sufficient reason to abandon it; and I named the rocks and river (the latter we never saw) Richthofen rocks and river, after Freiherr von Richthofen of Bonn, well known in geographical science. The right bank seems to be made of rounded hills of gray limestone, being picturesquely striped with the foliage of the dark evergreens growing in the ravines. A number of salmon-trout were caught in this last lake (the first one was secured in Lake Bove), the largest of which weighed over eight pounds, the limits of our pocket fish-scales.

On the 9th, at 10.30 A.M., we bade adieu to lake navigation, our hearts much lighter for the fact. That same day we saw a grizzly or immense brown bear, whose rapid departure gave us very little chance for close inspection. Our Indians say in regard to the scarcity of game, that the moose and caribou follow the snow-line as it retreats up the mountains in the spring and summer; also that the moose do not build 'yards' in the winter, as in Maine and the Canadian provinces. On the same day we passed the mouth of the Newberry River (after Professor John S. Newberry of New York), coming in from the east, about a hundred and twenty-five yards wide; and the Yukon at once became very much deeper, swifter, and the water of a darker hue, showing that the Newberry drained a considerable amount of 'tundra' land, or land where the water, saturated with the dyes extracted from dead leaves and mosses, is prevented from clarifying itself by percolating through the soil, by an impervious substratum of ice, and is carried off by superficial drainage directly into the river-beds. Forty miles farther on, measured along the stream, comes in the D'Abbadie,[1] over a hundred and fifty yards wide at its mouth, and said to be over two hundred and fifty miles in length. It notes an important point on the Yukon River as being the place at which gold in placer deposits commences. From the D'Abbadie to the very mouth of the great Yukon, a panful of 'dirt' taken from almost any bar or bank with any discretion, will, when washed, give several 'colors,' to use a miner's phrase. Another forty miles, and the Daly River comes in from the east, forming, with the Newberry and D'Abbadie, a singular triplet of almost similar rivers. The last I have named after Chief-Justice Daly of New York, a leading patron of my Franklin search expedition.

The prevalence of the larger rivers to the east showed this to be the main drainage area of the upper Yukon, a rule broken only by the Nordenskiöld River coming in from the west,

[1] M. Antoine D'Abbadie, membre de l'Institut de France, Paris.



VIEW IN MILES' CAÑON FROM ITS SOUTHERN ENTRANCE.
The only cañon, and head of navigation, on the Yukon, 1866 miles from Aphoon mouth.

fifty miles beyond the Daly, and the peer of any of the three. We passed its mouth the 11th, and that same day our Indians told us of a perilous rapid ahead that the Indians of the country sometimes shot with their small rafts; but they felt very anxious in regard to our very bulky and clumsy one of forty-two feet, as there were some sharp bends to make. Reaching the rapid on the 12th, I found it to be a contraction of the river-bed into about one-half its usual width of five hundred to seven hundred yards, and further impeded by a number of massive trap rocks, thirty to forty feet high, lying directly in the channel, and really converting it into three or four well-marked channels, the second one from the east being the usual one used by the Indians, but rejected by us on account of a necessary sharp turn. We essayed the extreme right-hand passage, although running waves three and four feet high were seen in its boiling current, but still the straightest, and therefore the best. On these rocks innumerable numbers of gulls had sought a breeding-ground, safe from all intrusion, and saluted us with a perfect din of screamings as we rushed by. This extreme right-hand channel through which we shot, I believe could be ascended by a river-steamer with a steam windlass, a sharp bend in the river-bank giving a short and secure hold; and, if I am right in my conjectures, Miles' Cañon and rapids mark the head of navigation on the Yukon for very light-draught but powerful river-boats, or a total navigable distance of eighteen hundred and sixty-six miles from the Aphoon mouth. I named this picturesque little rapid after Dr. Henry Rink of Copenhagen, a well-known Greenland authority.

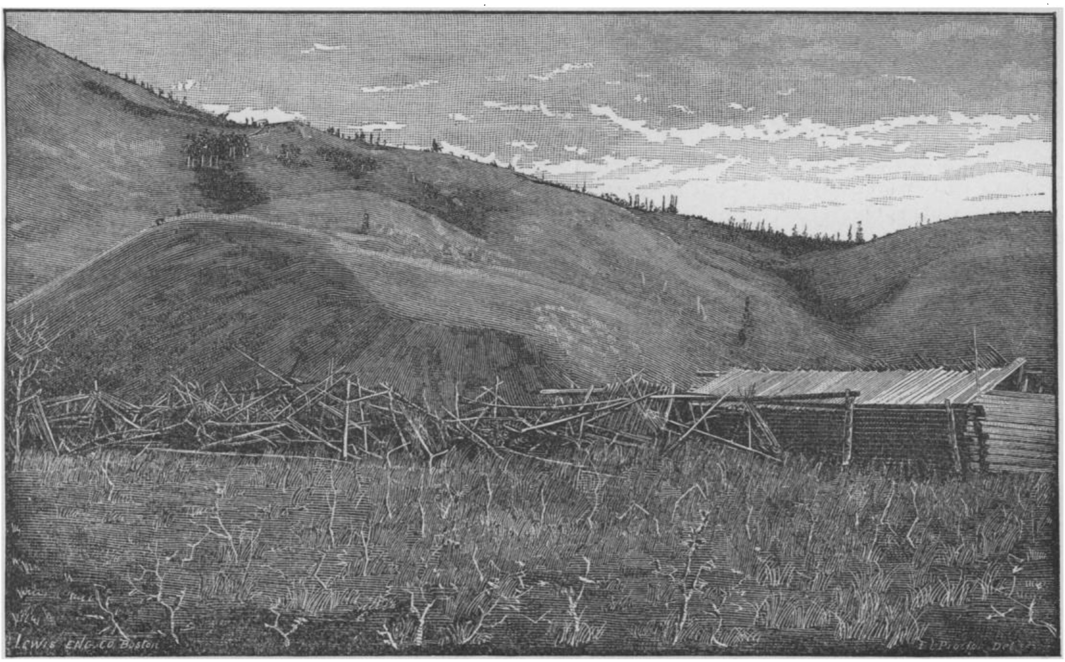
After the Yukon receives the many large rivers I have noticed, it swells out into quite formidable proportions, interspersed with many islands, all of which are so loaded with great piles of driftwood on their upper ends, that, when in one of these archipelagoes, the scene up and down the river is quite different. The river also becomes very tortuous in many places; and at the mouth of the Nordenskiöld a conspicuous bald butte could be seen directly in front of our raft no less than seven times, on as many different stretches of the river. I called it Tantalus Butte on the map.

The day we shot the Rink Rapids we also saw our first moose ploughing through the willow-brush like a hurricane in his endeavors to escape, — an undertaking in which he was successful. That same night we camped near the first Indian village we had met on the river, and even it was deserted. It is called Kit'-

ah-gon (meaning the place between high hills), consists of one log house about eighteen by thirty, and a score of the brush houses usual in this country; that is, three main poles, one much longer than the rest, and serving as a ridge-pole on which to pile evergreen brush to complete the house. This brush is sometimes replaced by the most thoroughly ventilated reindeer or moose skin, and in rare cases by an old piece of canvas. Such are the almost constant habitations of these abject creatures. In the spring Kit^{l}-ah-gon is deserted by the Indians, who then ascend the river with loads so light that they can be carried on their backs. By the close approach of winter-time they have worked so far away, accumulating the little salmon, moose, black bear, and caribou, on which they are to subsist, that they build a light raft from the driftwood on the islands, and float down to live in squalor through the winter. These rafts are almost their sole means of navigation from Miles' Cañon to Fort Selkirk, and the triangular houses almost their only abodes; and all this in a country teeming with good enough timber for log-houses, and plenty of birchbark for canoes. Kit^{l}-ah-gon is in a beautiful large valley,[1] as its name would impart; and I was surprised to see it drained by so small a stream as the one, but ten or fifteen yards wide, which goes out at its foot. Its proximity to the Pelly forbids its draining a great area, yet its valley is much the more conspicuous of the two. Photographs of it and adjacent scenes on the river were secured before departing, and a rough 'prospect' in the valley showed 'color' enough to brighten the hopes of some enthusiastic miner for something he would prize more highly.

[1] Von Wilczek valley, after Graf von Wilczek of Vienna.

From Kit^{l}-ah-gon to old Selkirk is but a little over twenty miles; and the river is so full of islands in many places, that for long stretches we could hardly see both banks at a time. This, I think, is one of the ancient lakes to which I have alluded, although the report of a professional geologist would be needed to settle such a matter. I was very anxious to determine the relative sizes of the two rivers that joined just above Selkirk, as upon this determination rested whether the Pelly or the Lewis River of the old Hudson-bay traders was the Yukon proper; and I was fully prepared to make exact measurements, soundings, rate of current, and other data if necessary, to settle the point. This was only needed in a rough manner, however, as the preponderance of the Lewis River was too evident to require any exactness to confirm it.



INDIAN VILLAGE OF KIT^{L}-AH-GON IN THE VON WILCZEK VALLEY.

It is deserted in summer, and occupied in winter.

The ratio of widths is about five to three, with about the ratio of five to four in depth; the latter, however, being a very rough approximation. At old Fort Selkirk nothing but the chimneys, three in number, are left standing: the fate of this post has been alluded to in an earlier part of the article.

The latitude of Fort Selkirk is 62° 45′ 46″ north, and its longitude 137° 22′ 45″ west (Greenwich). Altogether on the Yukon River, this far, there had been taken thirty-four astronomical observations, four hundred and twenty-five with the prismatic compass, and two for variation of compass. I hope they have been sufficiently accurate; at least, to subserve all practical purposes of exploration in this country, until more exact surveys are demanded by the opening of some industry or commerce, should that time ever come. No meteorological observations were taken, the party not being furnished with instruments, and the rapid passage through a vast tract of country making their usefulness to science highly problematical. The nearest point to the upper Yukon, at which regular observations of this character are recorded, is the Chilcat salmon-cannery of the North-west trading company on Chilcat Inlet. The two are separated by the Kotusk Mountains, making meteorological inferences, therefore, very unreliable. Nearly a hundred botanical specimens were collected on the upper Yukon, and have been placed in the able hands of Mr. Watson, curator of the Harvard herbarium, for analysis. While only a limited and crude amateur's collection, it may throw some little light on the general character of the flora, as limited to the river-bed, which we seldom left in our more important duties connected with the main object of the reconnoissance.

The map is necessarily condensed for so large an area; and having been made hurriedly, and expressly for this article, it is not wrought so much for topographical effect as exactness within the limits possible under such circumstances. The map which will accompany my official report is on a much larger scale, and much better prepared in details. To Mr. Homan, my topographical assistant, is due all the credit relating to the map-making department, except simply the astronomical observations, and in those requiring an assistant, when he acted as recorder. The above account has mostly been taken in chronological sequence from my daily journal, and matters of the same character have thus been separated in different parts of the article. If, with all these defects, I have made clear my small addition to geographical research to the readers of *Science*, I shall feel deeply repaid for the great labor I had in securing it.

In my geographical nomenclature I have tried to observe the following rules. Wherever a descriptive name would assist any future traveller in identifying the object, I have applied it, to the exclusion of all others, Indian or civilized; as, Red Butte, Bald Hill, Cone-Hill River, Haystack Island, etc. Where Indian names are simple, I have tried to retain them, as Kotusk, Tahk-o, Tahk-heen-a, Kluk-tas-si, Dayay, etc. In all other cases, where the object was deserving of being named, I have not hesitated to attach the names of men worthy of such distinction, both personal friends in all branches of science, and those who have done something for geographical research, and without regard to country. In my larger map I have also added the native names, where they could be secured.

The total length of part first, the part explored and surveyed by this reconnoissance, was 538.8 miles; the total length of the raft-journey on part first, from camp on Lake Lindeman to Fort Selkirk, 486.8 miles; the total length of the raft-journey on Yukon River, from Lake Lindeman to Nuklakayet (being the longest raft-journey in the interest of geographical science), 1,303.2 miles; the length of Yukon River, 2,043.5 miles.

FRED'K SCHWATKA,
Lieut. U. S. Army.

NOTE ON THE FLORA OF THE UPPER YUKON.

LIEUT. SCHWATKA was able to make a small botanical collection from about the head waters of the Yukon, which is of considerable interest as an indication of the climate of the region, and as showing the range northward into the Yukon valley, of some species previously known scarcely beyond the British boundary. Lieut. Schwatka, ascending from the head of Chilcoot Inlet, crossed the main coast-range by the Perrier Pass at an altitude of 4,100 feet, coming at once upon the source of the Yukon River, in latitude 59° 40′. A descent of twelve miles brought him to Lake Lindeman; and upon the borders of this and other lakes within a distance of twenty-five miles, nearly equally on both sides of the sixtieth parallel, the larger part of the collection was made, between the 12th and 15th of June. The specimens gathered even at this date were in full bloom, excepting a few indicated in the following list

by parentheses, and the sedges and grasses, which were well developed.

Anemone parviflora.
Aquilegia formosa.
Aconitum Napellus, var.
Barbarea vulgaris.
Arabis petraea.
Cardamine hirsuta, var.
Viola cucullata.
Lupinus arcticus.
Rubus Chamaemorus.
(Poterium Sitchense?)
Saxifraga tricuspidata.
Saxifraga leucanthemifolia.
Parnassia fimbriata.
Ribes rubrum.
Epilobium spicatum.
Epilobium latifolium.
(Heracleum lanatum.)
Cornus Canadensis.
Antennaria alpina.
Arnica latifolia.
(Senecio triangularis.)
Vaccinium parvifolium.
Arctostaphylos Uva-ursi.
Bryanthus empetriformis.
Kalmia glauca.
Ledum latifolium.
(Moneses uniflora.)
Pyrola secunda.
Dodecatheon Meadia, var.
Polemonium humile.
Mertensia paniculata.
Polygonum viviparum.
(Betula glandulosa.)
(Alnus viridis.)
Salix glauca.
Salix Sitchensis.
Habenaria dilatata.
Streptopus roseus.
Carex (2 sp.).
Deyeuxia Langsdorffii.
Festuca ovina.
Lycopodium complanatum.
Lycopodium annotinum.

The rest of the collection was made as opportunity offered, during the descent to Fort Selkirk in latitude 62° 45′, which point was reached on the 13th of July. It included the following species: —

Anemone multifida.
Ranunculus Flammula, var.
Erysimum parviflorum.
Cerastium arvense.
Arenaria lateriflora.
Arenaria physodes.
Montia fontana.
Linum perenne.
Hedysarum boreale.
Rubus arcticus.
Fragaria vesca (?)
Potentilla fruticosa.
Amelanchier alnifolia.
Parnassia palustris.
Bupleurum ranunculoides.
Galium boreale.
Aster Sibiricus.
Achillea millefolium.
Artemisia vulgaris.
Arnica alpina.
Arnica Chamissonis.
Pyrola rotundifolia, var.
Primula Sibirica.
Myosotis sylvatica, var.
Pentstemon confertus.
Pentstemon glaucus (?).
Pedicularis flammea.
Chenopodium album.
Polygonum aviculare.
Zygadenus elegans.
Hordeum jubatum.

The species new to so northern a latitude are marked by italics. The season appears to have been as forward as I found it in 1868 in the lower mountain ranges rising from the plateau of western Nevada in latitude 40°.

SERENO WATSON.

THE INTELLIGENCE OF SNAKES.

NEITHER among the scanty early references to the serpents found in New Jersey, nor in more recent herpetological literature, are there to be found statements that bear directly upon the subject of the intelligence of snakes. Gabriel Thomas, writing of West New Jersey as long ago as 1698, quite ignores the fourteen species with which we are favored. Thomas Campanius, in his history of New Sweden, published in 1702, and which is based on the notes made by his grandfather during his brief stay in Pennsylvania sixty years before, also ignores our harmless snakes, but remarks of the rattlesnake (Crotalus horridus), "It has a head like a dog, and can bite off a man's leg as clear as if it had been hewn down with an axe." What may we not expect, when such statements as this are made by men of intelligence? Assertions equally absurd are not uncommonly made, even in these later days, when a correct knowledge of our common animals is supposed to prevail.

Nearly half a century later than the date of publication of Campanius' history, Peter Kalm, the Swedish naturalist, travelled in New Jersey, and spent much time, particularly in the southern counties of the state. In his entertaining volumes, he has made many references to our snakes, although not enumerating all of them, and mentioning some that certainly do not now exist. This author relates several wonderful stories of the fierceness of the black snake, as they were told to him, and likewise gives his personal experience with this same serpent, which, to his surprise, did not accord with what he had heard. The reason is plain enough. Kalm desired to know the truth, and took the experimental way of learning it. His knowledge of the snakes was gained by familiar out-of-doors intercourse with them, and it has stood the test of time. All that was needed, when he wrote, was the moral courage to say to the narrators of the marvellous stories, 'You are mistaken;' or perhaps, more wisely, he might have kept silent. The most conscientious man, if afraid of snakes, cannot tell the truth about them; and even in the case of the truly poisonous species, it is well to remember that 'the devil is not so black as he is painted.' Stress has been laid upon the exaggerated statements of authors when treating of snakes, for the reason, that, if there were any foundation for the marvellous stories narrated, it would prove conclusively that the serpent was indeed wise. But setting aside all the literature of the subject, and going directly to the woods and fields, what evidence do we find there of the intelligence of snakes?

On the farm of the writer there have been found eleven species of snakes, which is but four less than the whole number found in New Jersey. Of these eleven species, no one is venomous; and, it may be added, all are perfectly harmless, and, indeed, cowardly. It is true that when cornered they will show fight,

but it is the veriest make-believe; and it is very questionable if there is a snake among them all which could harm the smallest child, even if disposed to do so. This is strangely at variance with the current newspaper stories, I know; but those, like the anecdotes related by Kalm, are simply not true.

Of our common snakes, the most formidable in appearance is the black snake (Bascanion constrictor), and of this species scores of most wonderful stories have been told; yet the species is really very cowardly, and not disposed to resent interference at any time. It is, however, probably the most active, as it is the largest, of our serpents, and therefore is one well calculated to exhibit evidences of the possession of intelligence, and the best to study in regard to this subject. What, then, do we learn, when we seek out these black snakes in their chosen haunts? To find them, one must proceed cautiously; for they are possessed of a quick sense of hearing, and are on the alert the moment any suspicious noises are heard. Is it for this reason that they are considered quite rare in many places where they really are abundant? They have apparently learned wisdom by experience, and, knowing that if discovered they will be pursued, conceal themselves quickly if they suspect danger. I can in no other way satisfactorily describe such actions of these snakes as I have often witnessed; and the use of the phrase 'learning wisdom,' and of the word 'suspect,' implies necessarily the possession, on the part of the snakes, of a considerable degree of intelligence. How far the black snake is cunning, I have not been able to determine; but a chance remark in Heckewelder's 'Indian nations' would seem to indicate that the Indians had long been convinced that it was a cunning serpent, and I am disposed to accept their testimony in such matters as essentially correct. Heckewelder says the Indians gave to Gen. Wayne the name of 'Black Snake,' "because they say he had all the cunning of this animal, who is superior to all other snakes in the manner of procuring his food. He hides himself in the grass, with his head, only, above it, watching all around to see where the birds are building their nests, that he may know where to find the young ones when they are hatched."

Assuming this to be true, we have here an instance, not only of cunning, but of a very excellent memory. This seems incredible; but Mr. Romanes, in his volume on animal intelligence, remarks that snakes "are well able to distinguish persons, and that they remember their friends for a period of at least six weeks." If, therefore, a tamed snake can remember a person for six weeks, there is nothing very remarkable in its retaining the localities of birds' nests for a shorter period; for, between the building of the nest and hatching of the eggs, less than half that time elapses. The elaborate treatises on the power of black snakes to charm birds and squirrels may be passed by in this connection. That these snakes frighten little birds out of their wits by staring at them is occasionally true; but that the snake intentionally 'charms' its prey, as has been so elaborately and pathetically described, is sheer nonsense. Still, considering the black snake in a practical way, and seeing him under ordinary, not extraordinary, circumstances, it must be admitted that he possesses a considerable degree of intelligence. Indeed, the fact that this snake has, notwithstanding incessant persecution, been able to hold its own in the most thickly settled neighborhoods, is of itself a conclusive argument that it possesses decided intellectual power. It has at least sufficient wit to elude a host of enemies.

A far more abundant species, and one that is even better known and more dreaded than the black snake, is the harmless and very resentful hog-nosed snake (Heterodon platyrhinos). It has a variety of common names, — such as 'adder,' 'viper,' and 'flat-head,' — of which the last alone is at all appropriate. It is true that it flattens its head, hisses loudly, springs menacingly, and snaps fiercely; but it is harmless nevertheless.

As an object of study, it presents much that is of peculiar interest. Without fangs, or even teeth of sufficient length to produce a wound beyond a mere pin-prick, it presents the outward appearance, and has the pose and movement, of the deadly rattlesnake. Wholly unable to inflict the slightest injury, it has always puzzled me to understand why it should not, like all our other snakes, seek safety in flight. May we hold that it realizes the full meaning of the peculiar powers of the venomous serpent it mimics so admirably, and trusts to its being mistaken for a rattlesnake? Indeed, this mimicry has been perfect in some instances that I have witnessed; inasmuch as the tail of the snake was rapidly vibrated against dead leaves, and so produced a sound that was strikingly similar to that of the rattlesnake. This similarity was, of course, accidental, as it was by mere chance that dry leaves were lying about; but, at various other times, I have noticed that the tail was held in the same position, and vibrated in precisely the same

manner, as that of the rattlesnake. In these instances I thought I detected a faint whirring sound, or a buzzing; but on this point I am not positive.

Mimicry on the part of snakes is a ready way of explaining some of their habits; but, even when accepted, it remains to be shown how it originated. Is there any evidence that in former times the hog-nosed snake and rattlesnake were intimately associated? I find none, and certainly at present the two species are not found together. I have endeavored to detect something in their habits, haunts, and anatomy, that could throw light upon this question, but as yet all in vain. I can only say that the snake is in appearance a deadly rattler, but that it has neither the rattles nor the fangs. A veritable impostor is he, sailing under false colors throughout his whole life. How far has conscious mimicry had to do with this? If any thing, a high degree of intelligence is implied; but, even if the peculiar habits of the species were acquired without reference to other snakes, does not the fact that it relies upon worthless means of safety imply that it recognizes them as calculated to strike terror in the breast of its tormentor? That this snake should generally refuse to seek safety by running away, but depend upon actions which cause no harm to its enemies, seems, at first glance, to be the height of stupidity; but, when we recall the fact that it is a perfect imitation of the defensive movements of a venomous species found in the immediate neighborhood, then the question arises whether it may not be conscious imitation. If so, this snake, which is really quite sluggish in its movements, may be far more cunning than we suspect.

There is another species that to a certain extent imitates the rattlesnake, but whether intentionally or not, remains to be determined. This is the milk snake (Ophibolus doliatus). This species, when found in the woods coiled upon a heap of dead leaves, will often closely imitate the peculiar rattle of the Crotalus by vibrating the tail with great rapidity, and in such a manner as to strike the leaves beneath it. This I thought to be accidental in the case of the hog-nosed snake, but believe to be intentional in this instance. I do not go so far as to state that it is an intentional imitation of the rattle of the Crotalus, but that the snake vibrated its tail against the dead leaves that a decided volume of sound might be produced. This implies that it believed that a defensive pose at the time, coupled with a rattling sound, would cause the intruder to withdraw: at least, it depended upon them rather than upon running away, when surprised. We certainly have, in such cases, exhibitions of choice, on the part of snakes, between two means of defence when overtaken by enemies. Does not the exercise of choice between two equally available means of accomplishing an object imply the possession of a considerable degree of intelligence? A beautiful green snake (Liopeltis vernalis), which I kept in semi-confinement for several months, exhibited many evidences of considerable intelligence. It became very tame, and evidently recognized me. Although allowed considerable liberty, it did not seem to be very active during the day, but was restless in the evening. It seemed to be more sensitive to cold than any of our other snakes, and remained under its little blanket when the day was rainy, or a strong east wind prevailed. It fed upon flies, which it would take from my hand, seizing them very leisurely, and swallowing them deliberately. There was nothing of the snap and gulp of a salamander or toad about the process. When, however, the snake went fly-hunting on its own account, there was a very different state of affairs. There was still great deliberation, but only until the moment for action arrived; and then, with a snap, the fly was gone.

Occasionally this pet snake would creep among a number of pots of flowers, and coil about the green branches. At such times it would frequently extend some three or four inches of its body outward and beyond any support, and thus remain, as rigid and apparently lifeless as a twig. This, probably, was a habit common to the snake when free; but why it should be indulged in under such changed surroundings, I cannot imagine. Certainly it was not for the sake of seizing its food; for I noticed that the snake, after taking a hearty meal, would assume this position, and that it did not ordinarily assume it when asleep. In its proper home, such a habit, on the part of a small snake of this color, would render it for the time very secure against such enemies as were guided only by sight. Even when standing very near the rose-bush upon which my pet rested, I found it, when in this position, a very inconspicuous object.

If this position, then, was assumed as a means of safety, it is a habit indicative of much cunning; for it acquires thereby the best chances for seeing about it, with the least probability of being noticed.

Of the seven other species of snakes found here, I have nothing special to remark. It is sufficient to say that the general impression

which these snakes give me, as I chance upon them in my rambles, is, that they are cowardly but cunning. Blessed with acute hearing and sharp sight, they use both of these faculties to the best advantage in the two important events of their daily lives, — the capture of their food, and eluding their enemies. After thirty years of familiarity with the snakes found in this neighborhood, I can truly say of them, as serpents they are *wise*, and add, they are harmless as doves.

CHARLES C. ABBOTT, M.D.

PRESENTATION OF THE RUMFORD MEDALS TO PROFESSOR ROWLAND.

THE special business announced for the meeting of the American academy of arts and sciences on the evening of Feb. 13 was the presentation of the Rumford medals, which, at the annual meeting in May, had been awarded to Prof. Henry A. Rowland of Baltimore. Before presenting the medals, the president of the academy, Professor JOSEPH LOVERING, made the following address: —

The medals awarded to Professor Rowland have been struck at the Philadelphia mint, and appropriately engraved under the direction of the Rumford committee. Their delivery to the recipient has been postponed for several meetings, under the hope and expectation that Professor Rowland would find it convenient to be present, and receive the medals in person. His attendance with us now is warmly welcomed, and adds greatly to the interest of the occasion. I ask your kind attention to a brief statement of so much of the scientific work of Professor Rowland as justifies the award of the Rumford premium, and of the relation in which these researches stand to the present condition and needs of physical science.

Astronomy, at least that part of it which relates to celestial mechanics, has presented for many generations unchallenged claims to a precision not attainable in any other science. The comparative simplicity of its problems, involving only the familiar and measurable units of mass, space, and time, has enabled it to attain and to hold this distinguished position, in spite of the fact that all the senses except vision are excluded from its study. If it has received any assistance from the experimental laws of mechanics, much more have these laws been illuminated by the motion of the planets, where friction and other resistances do not interfere.

After Grove, in 1842–43, had published his lectures on the correlation of the various physical forces; after Mayer, Helmholtz, and others had published their conclusions (the deductions partly of theory, and partly of experiment) that these different forces were mutually convertible; and after the view first seized in prophetic vision by Bacon, Locke, and Winthrop, was experimentally established by Rumford, Davy, Joule, and numerous coadjutors, and with ever-increasing clearness, that the assumed caloric was imaginary, and that heat was only one kind of motion in ordinary matter, — then it was possible to introduce unity, harmony, and precision into all the physical sciences by making the familiar units of measurement universal. As other forms of energy (mechanical, electrical, magnetic, chemical, capillary, radiant, and gravitation) can be converted, directly or indirectly, into heat-energy, heat has become a universal standard of energy, current everywhere in science, and redeemable. Hence it has become of prime importance to determine the mechanical equivalent of heat: the amount of heat, for example, which corresponds in energy to a given mass falling through a given height in a given latitude. In this way heat and all its dependencies will be measured by the units of ordinary work. For more than forty years, physicists in difference countries, and by various methods, led by Joule, have been engrossed with this measurement, reaching results which have slowly but happily converged towards a common agreement.

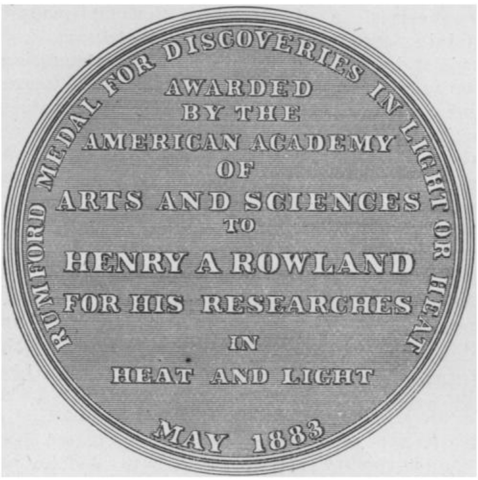
Professor Rowland, after a historical and critical review of the methods and results of older cultivators in this rich field, has turned up the soil anew, deepening the furrows.

The fruits of his long and patient labor were made known to the academy in 1879, in vol. xv. of the Proceedings. New apparatus was devised; the comparative merits of mercurial and air thermometers were discussed; and the various constants of science which enter into the case were re-examined. The research is a model of ingenious and conscientious experimentation, and was not published until it had received from its author the same severe criticism which he had applied to the work of others. That his final conclusion harmonizes so well with the best of Joule's, increases our confidence in both. A larger discrepancy might have given a greater show of originality; but science would have paid for the novelty by a loss of security, and another revision of the whole subject would have been entailed upon it.

When Newton announced his dynamical theory of the solar system, as simple as it was comprehensive, it made slow headway against the fanciful hypothesis of Descartes which was intrenched in all the universities of Europe. And yet Newton's theory reposed upon a firm mathematical foundation; while that of Descartes submitted to no quantitative tests, and contradicted all the known laws of mechanics. The history of astronomy from that time almost to the present moment tells of ever new victories achieved by the combined attacks of the telescope and mathematical analysis in the province of celestial mechanics, presenting the law of gravitation as supreme dictator to planetary and sidereal systems. But these triumphs, complete in their details, and grand in their cosmical range, were limited to questions which concern the distances, motions, dimensions, and masses of the heavenly bodies. The law of gravitation can assign a value to the quantity of matter in planets and binary stars; but it asks and can answer no question in regard to the quality of this matter,

only so far as a comparison of the size and mass of a body gives a measure of its density. That an instrument would be invented or developed which would complement the mechanics of the heavens by the chemistry of planets, comets, and stars, so that a physical observatory would become a necessary adjunct of the old observatory, was beyond the hope of the most sanguine astronomer, down to the moment of its actual realization.

Newton owes his singular fame, not exclusively to his discovery and expansion of the law of gravitation, but partly to his experimental researches in optics. That he did not recognize the dark lines in the solar spectrum has been explained by the statement that he was obliged to use the eye of an assistant in these experiments, on account of an injury to his own. Be this as it may, the existence of these lines was first known to Wollaston in 1802; and from that moment



the spectroscope and spectrum-analysis, as we now understand them, were possibilities.

Although Fraunhofer made a careful study of these lines in 1824, and Brewster, Herschel, Talbot, Draper, and many others pursued the inquiry by way of experiment and explanation, and stood upon the threshold of a great discovery, the spectroscope and spectrum-analysis, as practical realities, date from the investigations of Kirchhoff and Bunsen in 1862. Not only does the spectroscope carry chemistry into regions tenanted only by planets, comets, stars, and nebulae, and reveal motions in the direction of the line of vision, otherwise hopelessly beyond recognition, but it competes with the ordinary chemical analysis of bodies which can be handled, and has detected new substances which had escaped the vigilance of the chemist. Some of these results can be realized with simple instruments: others require a compound spectroscope consisting of a battery of prisms. It was a great step in the way of simplicity and ease of manipulation, when the diffraction-spectrum, produced by fine lines ruled upon glass or metal, was substituted for the spectrum produced by the combined refractions of many prisms. And here we touch upon the researches of Professor Rowland in light, which enhance his claim to the Rumford premium.

Professor Rowland's improvements in the diffraction-spectrum are manifold. 1. He has substituted for the flat plate on which the grating was formerly ruled a spherical or cylindrical surface. 2. He has ruled these lines to such a degree of fineness that 5,000, or 42,000, or even 160,000, have covered only one inch. 3. This exquisite work was executed by a machine of his own invention, and produced spectra free from the so-called ghosts which result from periodical inequalities in the ruling. 4. By making the curvature of the ruled plate discharge the office of a lens, he has avoided absorption at the violet end of the spectrum. 5. By his simple mechanical arrangements, different parts of the spectrum can be photographed with a great economy of time, and with such excellence of definition that old lines are subdivided, and new ones spring into visibility: in the words of a competent authority on the subject, 'the gratings of Mr. Rowland make a new departure in spectrum-analysis.' 6. Finally, his mathematical exposition of the theory of gratings has explained observed anomalies, indicated the conditions of success, and prophesied the limits at which future improvements in spectrum-analysis must stop.

PROFESSOR ROWLAND, It is now my duty, and certainly it is a most agreeable one, to present to you, in the name of the academy, the gold and silver medals which constitute the Rumford premium. Count Rumford, in conveying this trust to the academy through President John Adams, expressed a preference for such discoveries as should, in the opinion of the academy, tend most to promote the good of mankind. The practical applications of science are

numerous and valuable, and are sure of popular recognition and reward; but they often come from the most unexpected quarters. No one can predict what wonderful points of contact may be suddenly revealed between a purely theoretical investigation and the practical utilities of life. Meanwhile, a deeper insight into the laws of the material universe, extorted from a reluctant nature only after long and patient labor and thought, and many disappointments, becomes a permanent possession for mankind; and, as long as man does not live by bread alone, it is for him a perennial blessing. The academy, in awarding the Rumford premium to you, has indicated the kind of scientific work which, in its opinion, tends most to promote the *highest* good of mankind.

I ask you to accept, with these medals, my warm congratulations, and the cordial good wishes of all the members of the academy here assembled to administer Count Rumford's trust.

On receiving the medals, Professor ROWLAND spoke as follows: —

MR. PRESIDENT, AND GENTLEMEN OF THE ACADEMY, I thank you for the honor you have conferred upon me, which I can but regard as the greatest honor of my life.

In receiving these medals, I am pleased to think that they have been conferred upon work which is not the result of a happy accident, but of long and persistent endeavor.

There are some investigators whose disposition permits them to follow their aim, inspired by the mere love of the labor and the work. There are others to whom the sunshine of appreciation is necessary. To either class, appreciation, when it comes, is always acceptable; and I assure you that the judgment set upon my investigations by this academy is highly valued by me.

It has been intimated that a short account of my work would be of interest to the members of the academy. My attention was first called to the construction of dividing-engines by an inspection of a dividing-engine constructed by Prof. W. A. Rogers, at Waltham, in this state. On returning to Baltimore, I devoted much time to the general problem of such machines; and, through the liberality of the trustees of the Johns Hopkins university, I was enabled to construct an engine. In about a year this engine was finished. It worked perfectly the moment it was put together, and it has not been touched since. In order to rule diffraction-gratings, I reflected that it was necessary that the screw should be perfect, and that the rests for the plate which receives the ruling should also be as perfectly adjusted as is necessary in optical experiments.

The process of making the screw consisted in grinding it in a long nut in which it was constantly reversed. When this screw was finished, there was not an error of half a wave-length, although the screw was nine inches long.

When the dividing-engine was completed, my mind was occupied with the problem of the best form of surface to receive the ruling. I speedily discovered, that, by ruling the lines on a concave mirror of long focus, I could dispense with a collimator and with the ordinary arrangement of lenses. I now rule gratings six inches long, with various numbers of lines to the inch. I find that there is no especial advantage in having more than fourteen thousand to the inch, with the ordinary conditions of ruling. Having made the concave grating, I invented a simple arrangement for mounting it, so that a photographic camera should move along the arc of a circle at one end of a diameter, upon the other end of which the grating was placed, and always remain in focus. With this apparatus, one can do in an hour what formerly took days. Moreover, the spectra obtained are always normal spectra, and every inch on a photograph represents a certain number of wave-lengths.

After finishing my apparatus, I found it necessary to study photography; and I therefore devoted much time to this subject, and made a special study of all known emulsions. I discovered that an emulsion containing eocene enabled me to photograph from the violet down to the D line; and other emulsions were used for the red rays. I have also been engaged in enlarging my negatives and in printing from these negatives. On these enlarged photographs lines are doubled which have always been supposed to be single. The E line is easily doubled. My map of wave-lengths is based upon Prof. Charles S. Peirce's measurements of the wave-length of a line in the green portion of the spectrum.

At the conclusion of Professor Rowland's remarks, many questions were asked in regard to his beautiful device for photographing the spectrum, and the enlarged photographs which he showed were carefully examined.

PROGRESS OF ELECTRICAL SCIENCE DURING 1883.

THE subject of electrical science has become so broad that he who desires to keep abreast of the line of advance, and also to be on some points in advance of others, must read an immense amount in the English, French, German, and Italian journals, and in the patent-office reports of the various civilized nations. This is generally recognized; and courses in electrical engineering have been established in England, and are about to be established in America. This increase of intelligent appreciation of the magnitude of the subject of electricity is one of the features of the past year.

Perhaps the most important text-book that has appeared during the year is the English translation of Mascart and Joubert's treatise on electricity, with new notes by the authors. Clausius, also, has published a treatise on the theory of the dynamo-electric machine; and there have been numerous articles in various magazines upon the general subject of mathematical electricity.

The electrical congress which met in Paris, October,

1882, discussed the following questions: 1°. A redetermination of the ohm. 2°. (*a*) Atmospheric electricity; (*b*) protection against damage from telegraphic, telephonic, and electric-light wires; (*c*) terrestrial currents on telegraphic wires; (*d*) establishment of an international telemeteorographic line. 3°. Determination of a standard of light.

After a prolonged discussion, it was concluded that further experiments upon the unit of electrical resistance were necessary before a standard ohm could be adopted; and the governments participating in the congress were invited to encourage independent determinations of this unit. The section on earth-currents and lightning-conductors recommended also that the various governments should favor systematic observations, and that independent lines should be provided for the study of earth-currents; that long subterranean telegraphic lines should be used also for this purpose. The section on the standard of light were in favor of employing as a standard the light emitted by a square centimetre of melting platinum. The congress was adjourned to October, 1883; and afterwards the French government notified the various governments participating in the congress, that April, 1884, would be a more agreeable time to the majority of the congress than October. It is probable, therefore, that the congress will re-assemble during the coming spring.

Since the last meeting of the congress, various new determinations of the ohm have been made. E. Dorn, by a modification of Weber's second method, used also by Kohlrausch, has obtained the following value: —

$$1 \text{ S. E.} = 0.9482 \times 10^{10} \frac{mm}{\text{sec.}},$$

where S. E. denotes the Siemens or mercury unit. Lord Rayleigh has obtained .986 as the mean of the results of three independent determinations of the British association unit. Professor Rowland is at present engaged upon a careful redetermination of the ohm, using his apparatus for determining the mechanical equivalent of heat as a check upon the electromagnetic methods.

The subject of the cause of electromotive force obtains and deserves attention. Exner has maintained that there is no known case of chemical action without the development of electricity, and also of the development of electricity without chemical action. Braun controverts this conclusion. Exner finds that in a cell with zinc and platinum electrodes, and iodine or bromine as the liquid, a difference of electrical potential is obtained, notwithstanding the fact that iodine and bromine are elements, and cannot, therefore, be electrolytes. Exner believes the cause of this current is to be sought in chemical change. Braun shows that Exner did not take sufficient precautions to insure the purity of the iodine and bromine, and also to prevent the disturbing influence of the aqueous vapor in the air. He shows that there are numerous cases in which we have a development of electricity without chemical action, and also strong chemical action without the development of electricity. It is beginning to be perceived that the subject of thermal chemistry requires also a consideration of electromotive force.

In a voluminous paper containing a large series of observations, Quincke endeavors to verify Maxwell's conclusion that the square root of the dielectric constant must be equal to the index of refraction for light of the same substance. The several methods adopted give results which are not in accordance with Maxwell's theory of light. Quincke explains the different results obtained by different observers, as follows: 1°. Experiments show a fluctuation in the values of the index of refraction which is due to the electric force; 2°. A comparatively long duration of the electric pressure causes a fall in the value of the index of refraction equivalent to the effect of a rise of temperature between 0.0001° and 0.1° C. (this increases with the difference in potential between the electrodes, and can be attributed to internal friction caused by electric attractions and repulsions between the particles of the fluid); 3°. The phenomena of the change of the index of refraction show that the electric pressure has no analogy with hydrostatic pressure; 4°. These changes in the index indicate changes in hydrostatic pressure in the interior of the fluid, which are caused by the electrical pressure, the fluid being set into vertical movements thereby; 5°. The electrical effects appear to be transmitted through the fluid by impulses, and not in a continuous manner.

Julius Elster and Hans Geilel show that Zamboni's dry piles can be used as accumulators. The copper pole of the pile is connected with the positive, and the tin pole with the negative, pole of a Holtz machine. After the latter has been worked for a few minutes, the dry pile is found to be charged. After repeated discharges, the pile is found to contain a charge of considerable intensity. The authors recommend the following form of pile. The plates of the pile are strung, by means of a needle, upon a silk thread, and then stretched between the poles of a Holtz machine. A pile of eleven thousand pairs of plates, of one square centimetre surface, after ten minutes' charging, gave sparks one millimetre long, and made a Geissler tube luminous. The light of the tube was continuous at first, and afterwards intermittent. These piles are well suited to exhibit to a large audience the principle of Planté's or Faure's accumulators.

An interesting report upon the transmission of power by electricity was presented by Cornu to the French academy in April, 1883. This report was that of a commission appointed to examine the experiments of Depretz. It was found that the work absorbed by the generatrix, and transmitted to the receptrix, increases with the velocity of the generatrix. Depretz has succeeded in transmitting nearly four and a half horse-power through a resistance of a hundred and sixty ohms, which represents a double telegraph-line of eight and five-tenths kilometres. The work received was thirty-seven and a half per cent of that spent. With a greater velocity of the generatrix, it seems possible to transmit power to greater distances than Depretz has attained. This

amounts to saying that a high electromotive force is necessary for this end.

Many experiments continue to be made upon the magnetizing-function of steel and nickel. Hugo Meyer has experimented with weak magnetizing-forces, and finds that, 1°, the magnetizing-function has a positive value for a diminishing magnetizing-force; 2°, it increases at first with the magnetizing-force; 3°, it increases, for weak magnetizing-forces, with the temperature. Professor Ewing of Tokio, Japan, maintains that soft iron can be far more retentive of magnetism than steel. His results and detailed experiments are awaited with great interest.

Experiments made in the physical laboratory of Harvard university during the year have shown that the action of magnetism upon the conduction of heat, which has been maintained by several investigators, does not exist in magnetic fields which are at least ten thousand times the strength of the earth's field in Cambridge; and doubts are thrown upon such an action in general.

Hall's phenomenon continues to attract attention. As is well known, Mr. Hall has shown that an electrical current, traversing a thin plate of metal which is placed in a strong magnetic field perpendicular to the lines of magnetic force, has an electromotive force exerted upon it. At first it was supposed that this showed that an electrical current could be affected independently of the medium through which it passes. Mr. Hall, however, showed that the effect was different in different metals, and that the first conclusion was untenable. Aug. Righi has modified Mr. Hall's apparatus, and has discovered that the action in bismuth is extraordinary, being five thousand times as strong as in gold. The effect in bismuth can be obtained with a permanent magnet; and Righi hopes to show the phenomenon by means of so feeble a force as the earth's magnetism.

Edlund has broached a theory that a vacuum conducts electricity, and that the high resistance in rarified tubes is due to a contrary electromotive force at the electrodes in the Geissler tubes. He showed, that, without the employment of electrodes, one can excite an induction current in a Geissler tube which is sufficient to produce light. He maintains that this would be impossible if the highly rarified gas were an insulator.

Among the comparatively new electrical instruments which have been described during the year, are modifications of Lippman's electrometer. This consists, as is well known, of a capillary tube, connecting at one end with a comparatively large receptacle of mercury, and at the other with a vessel containing diluted nitric acid. The superficial tension at the end of the thread of mercury in the capillary tube is changed by a difference of electrical potential. The terminals of a Daniell cell — connected, one with the acid, and the other with mercury — cause a movement in the mercury-column, which gives a standard by which electromotive forces in general can be estimated. The instrument is very sensitive, but requires great care to prevent inaccurate measurements. A. Chevet has devised a modification of Lippman's instrument, which he claims will show a difference of potential of $\frac{1}{1000}$ to $\frac{1}{10000}$ of a Daniell cell. Two flasks, with lateral orifices on the same horizontal line, are connected through these orifices by the tube of a thermometer open at both ends. The bulb-end enters the flask A, which is filled with mercury. The capillary end enters the flask B. This latter flask is filled partly with mercury, and partly with water acidulated with a tenth part of sulphuric acid. The capillary end of the thermometer enters the acidulated water. A platinum wire, P, insulated by a vitreous covering so as not to be in contact with the acidulated water, is in contact with the mercury of flask B. Another platinum wire, N, is in contact with the mercury of the flask A. By means of a commutator a difference of potential can be intercalated between the ends of P and N. The heights of the mercury and water in the flasks A and B are such, that, P and N being connected by a metal wire, the surfaces of separation of the liquids are in the region of the capillary portion of the larger end of the thermometer-tube. The movements of the meniscus is observed with an eye-piece. Electrometers of the class of Lippman's can be constructed by any one at comparatively no expense, and are already used by physiologists. Hard-headed physicists, however, regard such instruments with considerable doubt when quantitative measurements are to be made. The subject of electrometers in general is very important from the point of view of the exigencies of meteorological bureaus and the signal-service. Modifications of Sir William Thomson's instruments still maintain their pre-eminence. Among these modifications is an instrument invented by Edelmann of Munich, in which the box-shaped quadrants of Thomson are replaced by cylinders, and the flat needle also by a suspended cylinder-shaped needle. The writer of this article remembers to have seen, ten years ago, an instrument similar to that of Edelmann, which had been devised by Mr. Moses G. Farmer, formerly of the U. S. torpedo station at Newport. It is said that the insulation of Edelmann's instrument is not perfect.

The cause of the electricity of the atmosphere is still unknown. The experiments of Freeman and Blake have apparently shown that the evaporation of pure water does not produce electricity. Kalischer has lately tested the question whether the condensation of aqueous vapor is a source of electricity. He used a modification of Thomson's electrometer, and connected it, with suitable precautions, with twelve large beakers which were covered with tinfoil and were filled with ice. These beakers, in turn, were protected from extraneous electrical influences. The condensation of aqueous vapor upon the beakers produced no electrical effect which could be observed. The criticism that can be made upon the experiments of Blake and Freeman is, that on the earth's surface an immense evaporation results from salt water, and impurities in the water may produce a state of electrification. Moreover, it is impossible to experiment on evaporation on a sufficiently large scale in a laboratory. An infinitesimal amount of electricity may

be produced by evaporation, which, although too small to be observed, may yet be integrated over the surface of the earth into a large sum.

In looking back over the electrical year, we do not find any great discoveries. We notice, however, great activity in the process of refining old methods. The electrical exhibition at Vienna showed a host of applications of electricity to the arts. There was, however, no striking new invention like the telephone. In all civilized countries, the year has brought forth innumerable modifications of telephones and telephonic apparatus. When it had once been shown that even an imperfect sentence could be transmitted by electricity, the dullest inventor could discover, among the *débris* of his laboratory, magnets and electromagnets which needed but a slight twist here and there to be made into telephones. A touch of genius was necessary for the first twist; and then the whole electrical world had the seed of the invention. It is rumored that long-distance telephoning will soon be attempted with wires of low resistance.

Electric lighting continues to attract great attention; and more correct calculations are daily made, which will soon enable us to judge of the relative economy of incandescent lighting compared with gas. In an address to the Society of arts in London, the lamented Dr. Siemens — whose sudden death last December has been such a loss not only to electrical science, but to science in general — made an elaborate calculation of the cost of lighting large areas in cities, taking the parish of St. James in London as an example and also as a unit. He estimated that to light London to twenty-five per cent of its total lighting-requirements would require an expenditure of capital of fourteen million pounds, without including lamps and fittings; making an average capital expenditure of a hundred thousand pounds per district. Siemens estimated the cost of lighting by incandescence as twenty-one shillings and nine and a half pence per lamp per year; while to produce the same luminous effects in a good Argand burner costs twenty-nine shillings per year. This apparently shows that incandescent lighting is cheaper than lighting by gas, at the present price of gas.

Electric lighting seems to gain in the estimation of the public. Even the argument that if the electric-light companies were compelled to put their wires under ground the companies could not pay their expenses, and consequently that the public would lose the benefits of the electric light, has a strong influence upon many who prefer light to darkness in our city streets. The public, however, are only beginning to realize the dangers from the present method of running electric-light wires. A heavy storm at night might cause at any time disastrous conflagrations, from the electric-light wires coming in contact with other wires and with wood-work. The bulletins published by the Edison electric-light company show the great extension of his system. His plants are to be found in almost every civilized country; and the company are paying great attention to village plants.

The writer of this article is informed that the cost of lighting the great steamboat, The Pilgrim, is not far from that of gas, with a far better quality of light than gas could give. Lighting by incandescence is a great luxury; and, as soon as the public imagination has been sufficiently stimulated, it promises to become a necessity in many quarters. Other systems besides that of Edison are competing for the field opened for enterprise.

The practical applications of the storage of electricity, so called, have not been numerous during the year. It is maintained that it is more economical to use electrical accumulators than to light directly from dynamo-electric machines. There is still a wholesome fear of having several tons of lead left on one's hands in a disintegrated condition. Further experiments are necessary on an extended scale, with especial reference to a large factor of time, before electrical accumulators can be pronounced a practical success.

JOHN TROWBRIDGE.

BIOGRAPHIES OF NATURALISTS.

Heroes of science: botanists, zoölogists, and geologists. By Prof. P. MARTIN DUNCAN, F.R.S., F.L.S., etc. (London society for promoting Christian knowledge.) New York, *E. & J. B. Young & Co.* 348 p. 12°.

THE plan of the several volumes designated by the common title 'Heroes of science' is worthy of much commendation. It is a frequent and irritating experience of those who have become interested in scientific men's lives to find that they have a scant place in biographical encyclopaedias, and that even the greatest figures in that line of human activity are dismissed with epitaphal brevity of description. The proper way to meet this difficulty would be by preparing an encyclopaedia containing only the names of those who had contributed something to the store of science. 'Heroes of science' has a far simpler aim. Twenty-one names from the great muster-roll of men who may be termed naturalists are all that appear in this book. The first is that of Aristotle; the last, that of Lyell. The aim of the author is clearly to show how these men have played their parts, and something of the way in which they turned the course of science in their time. In this aim it seems to the present writer that Professor Duncan has attained a very substantial success. Within the slender space of two hundred and fifty small pages it is, of course, impossible to do any thing that can be called justice, to more than a score of very notable men, mostly of rich and varied lives; yet the reader will get a sense of their value to the world from the book, that he will not obtain elsewhere. Take, for instance, the life of Lamarck: though all too briefly told for true proportion, it is the best short account of

that true hero that can be accessible to the ordinary reader.

The greatest fault of the book is that the length of the text bears no sort of proportion to the importance of the men or their possible interest to the reader. Lamarck's life is one of the most picturesque of all scientific lives: it is more heroic in quality than that of any other given in the series. Lamarck gave as much or more to natural science than any other naturalist whose name appears here; yet to this man's eventful history but fifteen pages are given, while Sir Roderick Impey Murchison, from whom the world had little profit, who will find his place among naturalists of the second or third order, has twice the space allotted to him. Singularly enough, the one man who should have the first place among the modern men is not named at all. Darwin, who could have claimed a place in all the three divisions of the book as botanist, zoölogist, and geologist, is passed by. It may be that the book was prepared before the death of this great naturalist, and thus that the date does not represent the time of its printing. This is the only possible explanation of this startling omission.

The book is well printed. It has a sufficient table of contents, but no index.

GORDON'S ELECTRICITY AND MAGNETISM.

A physical treatise on electricity and magnetism. By J. E. H. Gordon. Second edition, revised, rearranged, and enlarged, in 2 vols. London, *Sampson Low*, 1883. 343 p., 27 pl., 151 illustr.; 332 p., 46 pl., 161 illustr. 8°.

The demand for a new edition of a work of this magnitude, within about three years of its first publication, is a sufficient indication of its real usefulness, especially when we consider the fact that the first edition was also republished in this country.

The general scope of this treatise is to detail every thing of importance which is known experimentally respecting electricity and magnetism, referring to, and following as closely as may be, the original memoirs.

The mathematical theory of the subject is omitted so far as possible; nevertheless, the connection between the experimental facts and the results of modern theory are constantly pointed out by very numerous citations and references, especially to Maxwell. Indeed, these may, perhaps, be best regarded as companion volumes to those of Maxwell, from which the reader may learn how far theory and facts are now known to be in accordance.

We feel, however, that the author's reading has been too much confined to what has been published in England, and that he has not gleaned the field with equal diligence elsewhere. For example: we find no notice of the remarkable discovery by E. H. Hall of a new action of the magnet on electrical currents.[1]

The principal enlargements of this new edition are contained in the three chapters, 33, 35, and 36.

Chapter 33 contains an account of the beautiful experiments of Mr. Tribe in determining the variations of potential along the surface of a metallic conductor immersed in a fluid-cell by means of the electrolytic deposit upon the conductor.

Chapter 35 gives an account of the hydrodynamical experiments of Professor Bjerkens, on the apparent attractions and repulsions between bodies which are pulsating or vibrating in a fluid, which attractions are due to the mutual action of the currents set in motion by the pulsations. The importance of these experiments lies in the fact that they afford a possible clew to the nature of the mechanism which transmits electric and magnetic forces through space. In the course of these experiments, Bjerkens succeeded in imitating mechanically most of the ordinary magnetic phenomena, and showed that his field of force was similar to the magnetic field.

Chapter 36 details the subsequent researches of Mr. Stroh, respecting the same phenomena. Mr. Stroh used air instead of water as the medium in which the currents were set in motion. In this medium it was possible to explore the field of force much more completely than in water, and so to arrive at a much more exact knowledge of the facts and their explanation.

The author reserves what he has to say upon the subject of electric lighting for another work, which he has nearly completed, and which is to be specially devoted to that subject.

BASSLER'S WEATHER.

The weather: a practical guide to its changes, showing signal-service system, and how to foretell local weather. By S. S. Bassler. Cincinnati, *Robert Clarke & Co.*, 1883. 54 p., illustr. 8°.

In spite of our ten years' familiarity with the weather predictions of the signal-service as published in the newspapers, the general reader has as yet a very slight acquaintance with the principles and methods of weather study. The official circular on the 'Practical use of mete-

[1] *Amer. journ. math.*, ii. No. 3.

orological reports and weather-maps,' published in 1871, to aid in popularizing the work of the signal-service, is not sufficiently detailed, and has never had a great circulation. Another edition of it, with additional illustration and mention of the many facts discovered by studies of the ten years of signal-service observations, is now much needed; for we have no book in this country occupying the place held in England by the excellent little volume on 'Weather-charts and storm-warnings,' prepared by Mr. Scott of the British meteorological office. An attempt in this direction has, however, recently been made by Mr. S. S. Bassler of the Cincinnati *Commercial gazette*, who aims to make "a practical guide to weather-changes, and a help to a better understanding of the weather reports and predictions daily issued," with especial adaptation to the Ohio valley. The ordinary sequence of atmospheric conditions accompanying barometric maxima and minima is briefly described and roughly illustrated; but we regret to find in the field of popular instruction, where conciseness, clearness, and accuracy are of prime importance, so many departures from these essentials. Error and inaccuracy of statement, as well as the omission of many important facts, for which ample space might be found by avoiding needless repetitions, indicate lack of acquaintance with the subject; and although the preface says that "it is not proposed to consider any of the conflicting scientific theories, many of them still mere assumptions that have been accepted as explaining the phenomena daily presented in our atmosphere," we find on p. 36 the following obscure and inaccurate statement concerning the origin of storms: —

"The warm, light, vaporized air may move high over the land, frequently over strata of dry cool air, in great volume, from the central meteorological zone, gradually sinking down and forming the germs of barometric fields of low pressure, which spread and develop into extensive storm areas. It is in such fields that the heat of the sun is concentrated and storm centres originated. The earth absorbing electricity from the air, electric disturbances of more or less violence, according to the intensity of the condition, are experienced. The absorption or withdrawal of electricity from the vaporized air produces sudden condensation, excessive precipitation, and change of temperature."

It is said farther on, that the tornado "has its origin in the enormous electric tension caused by the friction of opposing atmospheric currents of different temperature; and electricity is undoubtedly the active agent producing the appalling effects of tornadoes." Some physical demonstration of this very popular and very erroneous assumption would not be out of place after so unqualified an assertion. The pamphlet is better than nothing, but it is by no means a satisfactory piece of work.

ART-CATALOGUE OF THE NEW-ENGLAND MANUFACTURERS' INSTITUTE.

Catalogue of the art department of the New-England manufacturers' and mechanics' institute. Boston, *Cupples, Upham, & Co.*, 1883. 4°.

THIS catalogue certainly has a very alluring exterior, and leaves little to be desired in its general presentation of reproductions of certain sketches and pictures which were exhibited at the fair of 1883 in Boston. It is not our function to criticise the pictures, but the methods of reproducing the pictures and sketches by the various mechanical processes exhibited in the catalogue fall within the province of *Science*.

Still, a critic of the various methods of reproduction of pictures cannot limit himself entirely to a mere consideration of the thoroughness of the technical processes involved in such reproductions; for he would appeal only to the ardent follower of the albertype process, or to an etching process. He must decide as impartially as possible, which of the various methods exhibited, for instance, in this catalogue, gives an idea of the pictures which appeals to the artistic sense in the fullest way. From this point of view there is no doubt that the wood-engravings and the etchings in this catalogue are superior to the specimens of the albertypes, and to those of the photographic processes in general. No photolithographic process represents the values of the lights and shades of a picture except in the most solid and implacable manner. Witness the 'View on the Nile,' which represents a darbeah in the foreground, with some figures on the river-bank near it, a stretch of river and of low-lying hills. The reproduction has an air of *vraisemblance*, but nothing more. It is not artistic. The little picture entitled 'Give me a swing,' representing a pretty little girl leaning against a tree near a hammock, and coquettishly entreating some passer-by, is a better specimen of what an albertype can do. The remaining specimens of albertypes lose whatever clearness of definition a real photograph might possess, and render the blackness of shadow of many photographs in a still more pronounced way; so that the albertypes presented in this volume have the appearance of poor photographs. There are certain subjects, however, for the reproduction of which the albertype is suitable.

'The spring near Orange, N.J.,' for instance, renders the peculiar mistiness and indefiniteness of a New Jersey landscape at that time of the year with considerable truth. The fascination of a new process of reproduction makes one eager to extend it to all subjects; and it is only after a long period of comparison that one can get far enough away from this fascination to obtain clear judgment of the possibilities of the method. He who discovers for himself the possibilities of a pot of red paint in decorative art is at first apt to apply the paint to every thing.

The wood-engraver and the etcher have nothing to fear at present from the various lithographic and photolithographic processes, save in the cheap market. The various gelatine processes must necessarily intensify the want of half-lights which is a characteristic of many photographs, and must obliterate even the faint differences in the degree of darkness of shadows which the original photograph may show.

Heliotypes and similar processes stand in the same relation to the pictures they reproduce that music-boxes stand to the performance by the musician of the piece of music they strive to reproduce. The delicacy and freedom of the original performance is lost. This cannot be said of wood-engraving and etching. The wood-engravings and etchings in this catalogue are superior to the other methods of reproduction, and show a capacity for interpreting the sentiment and the skill of the artist, even to the extent, sometimes, of improving on the originals of which they are the reproductions. The progress of one's art-culture is generally from photographs to engravings, and from engravings to etchings; and a half-hour's study of this illustrated catalogue would hasten one's culture in this generally accepted way.

YARROW'S CHECK-LIST OF AMERICAN REPTILES.

Check-list of North-American Reptilia and Batrachia; with catalogue of specimens in U. S. national museum. By H. C. YARROW, M.D. Washington, *Government*, 1883. (Bull. U.S. nat. mus., 24.) 8 + 249 p. 8°.

IN this catalogue are included the names of three hundred and thirty-seven species and sub-species of reptiles, and one hundred and thirty batrachians, found in North America north of Cape San Lucas and Key West. The trinomial system of expressing the variations of widely distributed and variable species is adopted, as in the recent check-lists of birds; and the sub-species are numbered with the species. Each species and sub-species has been furnished with an 'English' name, although very few of them have any distinctive vernacular appellation in fact. The author observes, that to the task of ascertaining the English names in actual use has been added "the very laborious one of translating as literally as possible some of the polysyllable Greek and Latin names." This, it seems to us, has been a wholly profitless task. It is no gain to any one to call Amblystoma jeffersonianum platineum the 'slender salamander,' while the related Batrachoseps attenuatus is the 'slender lizard.' Nor is it evident why most, but not all, of the species of Plethodon, are called 'lizards,' while those of related genera are chiefly 'tritons' or 'salamanders.' Hemidactylium scutatum, although in no proper sense a lizard, and not scaly, is called the 'scaly lizard,' instead of the 'shielded little half-toe,' as its name would imply. Perhaps these English names of Dr. Yarrow are as good as any other set of made-up vernacular names; but, if so, it is time to protest against the whole business. Scientific names themselves are sufficiently trying without this additional incubus.

The classification and nomenclature of Dr. Yarrow's list is essentially that of the check-list of Professor Cope. Several additions have been made, and a few changes of name; most of the latter being in the group of turtles, and due to the studies of Mr. F. W. True. Some further changes in nomenclature must take place; as the substitution (already suggested by M. Boulenger) of 'Cryptobranchus' for 'Menopoma,' of 'Necturus maculatus' for 'N. lateralis,' and the suppression of the generic name 'Muraenopsis,' pre-occupied among the eels.

After the check-list, follows a list of the specimens of each species in the National museum. This list is of very high importance as a contribution to our exact knowledge of the geographical distribution of species, and is, in fact, the *raison d'être* of the whole memoir. The bulletin is completed with a list of species desired by the museum, and with full index to scientific and vernacular names of species, and to the localities and names of persons mentioned.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Mount Shasta. — In *Science*, No. 48, was mentioned Mr. Gilbert Thompson's suggestion, that Mount Shasta, in northern California, would be a good point upon which to establish a permanent meteorological station like those on the summits of Mount Washington and Pike's Peak. The following notes, obtained from Mr. Thompson, will perhaps make more apparent its suitability for that purpose.

Mount Shasta is a volcanic peak having an altitude of 14,511 feet above sea-level, and situated in latitude 41° 24′ 30″, and longitude 122° 11′ 34″. So prominent is it, that it rivets the attention even at a distance of over a hundred miles; and at Berryvale, where it rises over 11,000 feet in a distance of ten miles, its appearance is majestic. It is not part of a mountain range, and no mountains within a radius of forty miles from it attain the elevation of 9,000 feet. The greatest length of the north-west slope is sixteen miles to the edge of Little Shasta valley, which has an elevation of 3,000 feet. The south-western slope to Elk Flat (where the elevation is 4,000 feet) has a length of eight miles. The highest divide, six miles to the north-west, has an altitude of 6,000 feet; while the divide of the Sacramento River, ten miles to the westward, has an altitude of only 3,500 feet. The distance from the summit in any direction, to the contour of 8,000 feet, will not exceed four miles. The prominence and isolation of this volcanic cone are therefore obvious.

The point at which the growth of timber receives its greatest check is at an elevation of 8,200 feet. This limiting-line is a conspicuous feature in the view of the mountain as seen from a distance of forty or fifty miles, as it contrasts sharply with the snow. The last tree (so small that it was put in the vest-pocket) was found at 10,130 feet.

The streams that have their origin in the melting of the snows of Mount Shasta make their appearance suddenly as rushing torrents, which subside during the night, leaving only pools of clear water, which also gradually disappear. On the east side they have eroded deep cañons, in two of which are waterfalls 400 feet in height. After the first snow, the flow of water from the mountain ceases until the following spring. Only two streams can be considered as permanent. There are but few springs; as all this water sinks near the base of the peak, to re-appear at distant places in an unexpected manner as springs of immense size. The hot sulphur-springs, or solfataras as perhaps they should properly be termed, which are now in active operation at the summit of the peak, once extended considerably farther to the south-east. An additional spring was discovered last summer, under the summit to the eastward. The myth of the Win-tún Indians, that Mount Shasta is the assembly-house of the gods, probably had its origin in the existence of these springs. The more prosaic imagination of the topographer suggests that the steam from these vents might be utilized to heat a station built on the summit of the mountain.

Topographic work in the southern Appalachians. — Party No. 2 of the southern Appalachian division, Morris Bien in charge, was engaged during the past season in the north-eastern part of Tennessee, the north-western part of North Carolina, south-western Virginia, and southern West Virginia, — an area of about six thousand square miles, lying between parallels 36° and 37° 30′, and meridians 81° and 83° 30′.

The topography of this area is of the same character as that found by party No. 3 in the Tennessee valley; except, that, in the portion lying in North Carolina, the character of the former is combined with a system of spurs radiating from a sort of central knot, — a feature reminding one somewhat of the Rocky Mountains. This similarity to western topography increases as we go southward on the eastern side of the range, until, in the Black Mountains, it becomes very marked. Another striking difference is, that here there is no apparent underground drainage of the sink-hole nature. In south-western Virginia, however, the drainage is similar to that of the Tennessee valley, and quite as striking.

A curious example of the sinking and re-appearing of streams is found in Scott county, Va. There is a completely enclosed basin in which a considerable creek gathers, and flows toward the Clinch River, from which it is separated by a continuous ridge about three hundred feet high. At the foot of this ridge the stream disappears, and, as has been proved by marked slabs, flows beneath the ridge and under the river, appearing as a spring about half a mile from the river, and on the opposite side of it. The underground course of the stream must be somewhat like an inverted siphon. The sink of the creek is about twenty feet higher than the river, and nearly the same height above its outlet at the spring.

In the same county is the natural tunnel of Stock Creek. At about eight miles from its head, the ravine in which Stock Creek flows is closed in by a distinct cross-ridge about four hundred and fifty feet high. The creek, which is about fifteen feet wide and three feet deep, has made an S-shaped tunnel through the ridge about nine hundred feet long, and averaging fifty feet in width. It is nowhere less than ten feet high, rising at the entrance and outlet to over sixty feet.

The entrance is an almost perfect archway in a perpendicular rock wall which is nearly four hundred feet high, while the outlet is in a remarkable perfectly dome-shaped rotunda of which about half is wanting. The highest point of the dome is about four hundred and fifty feet above the creek-bed. Curiously enough, when visited last September, the creek sank entirely at the entrance, and re-appeared only at the outlet, not a drop of water being visible in the tunnel; whereas during high water a roaring torrent rushes through it. A preliminary line of the South Atlantic and Ohio railroad has been located in the

tunnel; and they propose to make a secondary tunnel, cutting an angle of the S in the natural tunnel.

There are enormous quantities of marketable timber throughout this whole section; cherry, walnut, oak, chestnut, poplar, hickory, etc., growing everywhere. In the extreme south-west of Virginia, fine large poplars are found in great abundance. In Shady Valley, Tenn., is an extensive forest of several thousand acres, in which are to be found most magnificent pines, straight as an arrow, and many over a hundred and fifty feet high.

The mineral wealth of the country has just begun to receive proper attention. Within the past few years the well-known Cranberry iron-mines have been opened, the ore from which is of very fine quality; and it is claimed that the same body can be traced, almost continuously, far north into Virginia. There are several copper-mines in the north-western part of North Carolina which await only the influx of capital to produce in large quantities. Gold has also been found in this section in small amount.

Throughout that part of south-western Virginia lying north-west of Clinch Mountains, coal is found in almost every ridge, and, at Pocahontas, is mined in large quantities. Copper and iron have also been found scattered throughout this section. This region needs only railroad facilities to become one of the richest districts in the east. It can supply coal and timber in enormous quantities; and, from all accounts, iron and copper mining would also be profitable.

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Franklin institute, Philadelphia.

Feb. 20. — Mr. S. Lloyd Wiegand presented a further communication respecting the use of cast-iron in the construction of steam-boilers; illustrating his remarks by bursting, under hydrostatic pressure, a model of the exploded Gaffney boiler, which had been the cause of a protracted legal controversy in Philadelphia. Mr. Wiegand protested against the sweeping condemnation of cast-iron as a material for steam-boiler heads, and especially deprecated the effort that had been made to commit the institute as a scientific body, to suit an expression of opinion without experimental verification. On Mr. Washington Jones's motion, a resolution was adopted, in which the national Congress is urged to appoint a commission of experts for the testing of iron, steel, and other materials used for structural purposes, and to make a suitable appropriation for the work of the commission. —— Mr. David Cooper exhibited a remarkably fine suite of specimens of direct life-size camera portraits, admirably illustrating the progress which has lately been made in dry-plate photography. These pictures were taken with dry plates prepared by the Eastwick dry-plate company of New York.

Canadian institute, Toronto.

Feb. 16. — Prof. J. Playfair McMurrich read a paper on the osteology of Amiurus catus, one of a series on the morphology and development of that fish. The paper treated particularly of the high specialization of Amiurus, as instanced by the small amount of cartilage in the skull, and by the great modification of the maxillae and of the pectoral and dorsal fins.

Princeton science club.

Feb. 14. — Professor George Macloskie reported his researches on the tracheal organs of insects, by which it appears that their spiral filaments are not independent structures, but crenulations or inward foldings, with thickening of the chitinous wall; that the spirals are really tubular, fissured at the line of infolding, and continuous with the enclosing wall. The function of aeration is discharged by air passing, not through the wall into the blood, but directly to the tissues by lung-like terminal cells, long ago described by Louis Agassiz, and shown by Max Schultze to be especially abundant near the luminous organs of the glow-worm.

Prof. H. F. Osborn reported, that in the opossum, unlike the kangaroos, the superior and inferior mesenteric arteries and coeliac axis arise from a common trunk above the renal arteries, — a reduction similar to that found in the monotremes.

Prof. W. B. Scott stated that the hind-foot of the American miocene Enteledon shows, like the European, the third and fourth metatarsals greatly enlarged, the second and eighth very rudimentary. The third is borne entirely by the external cuneiform; the middle cuneiform is very small, and coalesced with the external cuneiform; and the internal is very narrow, and articulates above with the navicular, and below with a hook-like process of the third metatarsal. The rudimentary second metatarsal is wedged in between the middle and internal cuneiforms. This type of foot corresponds to Kovalevsky's 'inadaptive type of reduction,' nearly half of the bearing-surface of the tarsus being unemployed.

Dr. McCay called the attention of the club to a letter in the last number of the *Jahrbuch für mineralogie*, from Professor Sandberger of Würzburg. In a pamphlet which appeared recently in Germany, McCay had attacked Sandberger respecting his alleged discovery of the rhombic modification of speiskobalt. McCay has proven that the honor of the discovery is due to Breithaupt of Freiberg; and Sandberger, convinced by the ample evidence, has in his letter admitted the correctness of the arguments advanced, and signified his readiness to withdraw his name 'spathiopyrite,' and to substitute in its place the Breithaupt term, 'safflorite.' Dr. McCay further reported upon eight analyses of argillaceous limestones, several of which seemed admirably fitted for making hydraulic cement.

Prof. C. G. Rockwood and Mr. Fine gave synthetic

demonstrations of the formula for the prismatoid, one section being made at will. —— Mr. Smith gave a new and simple demonstration of the ellipse of stress. —— Mr. Magie gave a proof for the movement of liquids in capillary tubes, both cylindrical and conical. —— Mr. M. McNeill gave a method for reducing to the mean time of observation a series of micrometer measures of distance and position angle, when one of the objects has such a large proper motion that these quantities do not vary proportionally with the time.

Society of arts, Massachusetts institute of technology.

Jan. 24. — Capt. D. A. Lyle, U.S.A., read a paper on the rise, progress, and methods of the U. S. life-saving service. The first organized attempt at saving life imperilled by wreckage was inaugurated by the Massachusetts humane society in 1782, but the true inception of the U. S. service was in 1848; and since that time, in spite of reverses, inadequate appropriations, etc., the service has steadily advanced in efficiency. It was established on its present enlarged basis in 1878, after several years of struggle. At present the whole number of stations is 189, of which 139 are on the Atlantic coast. The following statistics for the year ending June 30, 1882, will show the efficiency of the service: disasters, 345; property involved, $4,766,000; property saved, $3,106,000; persons involved, 2,398, of whom all but 12 were saved; total expense, $594,889.74, or at the rate of less than $250 per person, without considering the value of property saved. During the more inclement months, dangerous shores are constantly patroled; and upon discovering a wreck, a projectile is fired over the vessel, carrying a line, by means of which the sailors draw out a cable, which they secure to the mast, and on which a life-car or a breeches-buoy is run back and forth, by which those on board are carried to the shore. Capt. Lyle explained all the details of the methods used, by means of a model. —— Mr. N. M. Lowe exhibited a model showing a method of transmitting power by belting, designed to replace the ordinary fast and loose pulley.

Academy of natural sciences, Philadelphia.

Jan. 15. — Prof. H. C. Lewis exhibited a specimen of limestone from Utah which emitted a lurid red light when struck, scratched, or heated. The glow lasted from half a second, when lightly struck, to a much longer time as the result of a blow. On examination, the specimen proved to be an almost perfectly pure carbonate of lime, with but a slight percentage of impurities. It is loose-grained, white, and crystalline, the grains being but slightly coherent, thus giving the rock the appearance of a soft sandstone. It crumbles easily between the fingers, forming a coarse sand. When heated in a glass tube over a flame, it glows with a deep red light, which lasts for a minute or more after withdrawing the flame. After two or three heatings the phosphorescent property disappears. A search through the collection of the academy for limestones having similar properties resulted in finding specimens from Kaghberry, India, which glowed with a strong yellow phosphorescence when heated, although no such effect was produced by scratching or striking. It was of great interest to find that the Indian limestone alone, of all in the collection, had the precise external characters of that from Utah. This similarity is more than a coincidence. It confirms Becquerel's view that phosphorescence depends upon physical rather than chemical conditions. In the rocks referred to, it is probably dependent upon a disturbance of their loosely aggregated crystalline particles, whether such be produced by percussion, friction, heat, or decrepitation.

Dr. J. Leidy communicated the results of a recent trip made to Atlantic City for the purpose of collecting and studying some of the life-forms thrown up on the beach by the storm of Jan. 8. The shore at the highest line reached by the tide was for miles covered with millions of bushels of the common beach-clam, Mactra solidissima. In many places they were closely packed together in extensive patches. Besides those visible, it is probable that at least as many more were covered by the sand thrown up at the same time, or had buried themselves in the beach. Until this evidence of the storm he had no suspicion that the mollusk was so exceedingly abundant on the coast; though he had been well aware that it was very common, having repeatedly seen large quantities thrown on shore under similar circumstances. With the Mactra were other mollusks, which, although numerous enough, appeared to be few, compared to the former. These were Fulgur carica, and F. canaliculata, Natica heros, N. duplicata, and N. obsoleta. Hermit crabs were also abundant, — Eupagurus pollicaris in the shells of Natica and Fulgur, and E. longicarpus in shells of Natica. Spider-crabs were common, and a few half-grown horseshoe-crabs were also observed. Some bunches of the common edible mussels were collected.

It seemed remarkable, on the other hand, that some of the commonest mollusks were conspicuous by their absence; few or no oysters, clams (Venus mercenaria), squirt-clams, or horse-mussels, having been seen. Scarcely any traces of annelids were observed, except masses of dead Serpula. There were also no echinoderms, except one, Caudina arenata, which occurred at some places in considerable numbers. It was believed that this was the first time the animal had been observed on the coast of New Jersey. They usually range from three to four inches in length, but several were found upward of six inches, and over an inch in diameter at the thicker portion of the body. They present but little resemblance to the forms commonly recognized as echinoderms or sea-urchins, looking much like large fleshy worms. Dissection, however, at once reveals their true relationship.

It is an interesting question as to what becomes of the vast quantity of Mactra and other shells incessantly cast on shore. Storms annually oblige the ocean to contribute, from its inexhaustible stores, multitudes of mollusks and other animals to the sandy beach. By exposure to the influence of the weather, the air, the sun, the rain, frosts, and other destructive influences, the calcareous shells are broken

and decomposed, and in a comparatively few years entirely disappear. Carbonic acid of the rain-water must be a potent agent in their ultimate solution, as it percolates through the sand. While the beach receives its constant supplies of shells, no trace of these is to be found in the sand immediately back of the shore, which in former times received the same incessant contributions. For similar reasons, no doubt, calcareous fossils are comparatively rare in sandstones, though in many cases their impressions are well preserved.

NOTES AND NEWS.

LUDWIG LIEBRECHT of Lippstadt, in Westphalia, is endeavoring to obtain subscriptions from all countries to establish a memorial in honor of the late Dr. Hermann Müller, whose biography was briefly given in No. 36 of *Science*. The income is to be applied to the support of his family during the life of his widow, and thereafter to aid students of the natural sciences educated at the public school of Lippstadt.

— Professor John LeConte has contributed a series of physical studies of Lake Tahoe to the recent numbers of the *Overland monthly* (San Francisco), in which he sums up what is known of the lake, and suggests lines of work for studious observers to follow. The greatest depth sounded was sixteen hundred and forty-five feet, and the lowest temperature found was at the bottom, 39°.2 F. Like most deep lakes, this one does not freeze, because the winters are not long or strong enough to reduce its entire volume to a cold below this temperature of maximum density. The transparency and color of the water are discussed at length, and an abstract of the recent Swiss studies of lake-oscillations, or *seiches*, is given; as there is every reason to suppose they must occur in our lakes, although not yet recognized here. According to the most reasonable estimates of mean depth, the duration of the longitudinal *seiche* of Lake Tahoe, calculated by Forel's formula, would be eighteen or nineteen minutes; and of the transverse, about thirteen minutes. The lake-basin is regarded as a 'plication hollow' or trough produced between two adjacent and parallel mountain ranges.

— E. and F. N. Spon announce as in preparation 'A history of electricity and of the electric telegraph,' by J. J. Fahie.

— Messrs. Barry, an old wine and coffee firm of London, have since the middle of the last century kept a scale for the amusement of their customers. The results of the weighings have been regularly entered in books kept for the purpose, together with the ages and any remarks called for by the clothing or other condition of the person weighed. Francis Galton, in his search for statistical information of the progress of man, has examined these records, and published a notice of the results in *Nature* for Jan. 17. The weights of the nobility he especially studied, and they show that the variation in weight of this class during the year has steadily declined in the past hundred years from seven to five pounds. Not only is there this evidence of a more regular and healthy life, but the age of greatest weight, which, with the generation from 1740 to 1769, was reached at forty-five, being at that age about sixteen pounds more than the weight of the 1800–1829 generation at the same age. While from that age the entire generation declined in weight, the tables show that the English nobility born in the early part of this century continued to increase in weight till at least their seventieth year; at their sixty-second year reaching that of their grandparents of the same age, who had been growing lighter for nearly twenty years, the later generation rising in weight at almost the same rate at which the earlier declined. The men of the last century seemed to grow stout in early manhood, then to fall off, while those of the present increase steadily with their age.

— Prof. G. Seguenza continues his studies of the quaternary formation of Rizzolo. His last contribution is devoted to the Ostracoda, and comprises about thirty-two pages quarto, with an excellent plate. About thirty-five species are mentioned, and more are to follow. Ten species are well figured. These often elegantly ornamented little creatures have an enormous range; some of these Sicilian fossils being common to Norway, New Zealand, and Sicily, either living or fossil. A number of new species are described.

— Late signatures of the Proceedings of the U. S. national museum contain a catalogue of mollusca and echinodermata dredged on the coast of Labrador by the expedition under the direction of Mr. W. A. Stearns in 1882. This list, which is carefully annotated, covers eleven pages, is illustrated by a plate, and is more complete than any thing hitherto published. It is due to Miss Katherine J. Bush of New Haven. This, and another paper by Rosa Smith in the same issue, would seem to indicate, that at last, if somewhat tardily, women are about to claim their share of work and honors by serious zoölogical investigations.

— Herr R. J. Runeberg, who has been examining the Angara River between Yeniseisk and Irkutsk at the request of Sibiriakoff, has returned to St. Petersburg. He reports that the rapids which obstruct navigation on the upper part of the Angara may be easily removed so as to admit of regular traffic on this important Siberian waterway.

— In a lecture by the Russian academician, Fr. Schmidt, on the Vega voyage, the author sees strong reasons for doubting the sanguine view of Nordenskiöld, that commerce may generally or even frequently find a waterway along the coasts of the Siberian Sea. He recalls, among other evidence, the experience of Rakhmanin, who wintered twice at Spitzbergen, and not less than twenty-six times in Novaia Zemlaia, and who found the way to the Yenisei open on only five occasions.

— A society of natural history has been organized at Sedalia, Mo.; and an address by F. A. Sampson, indicating the objects specially in view, was printed in the Sedalia *Daily democrat* of Feb. 13.